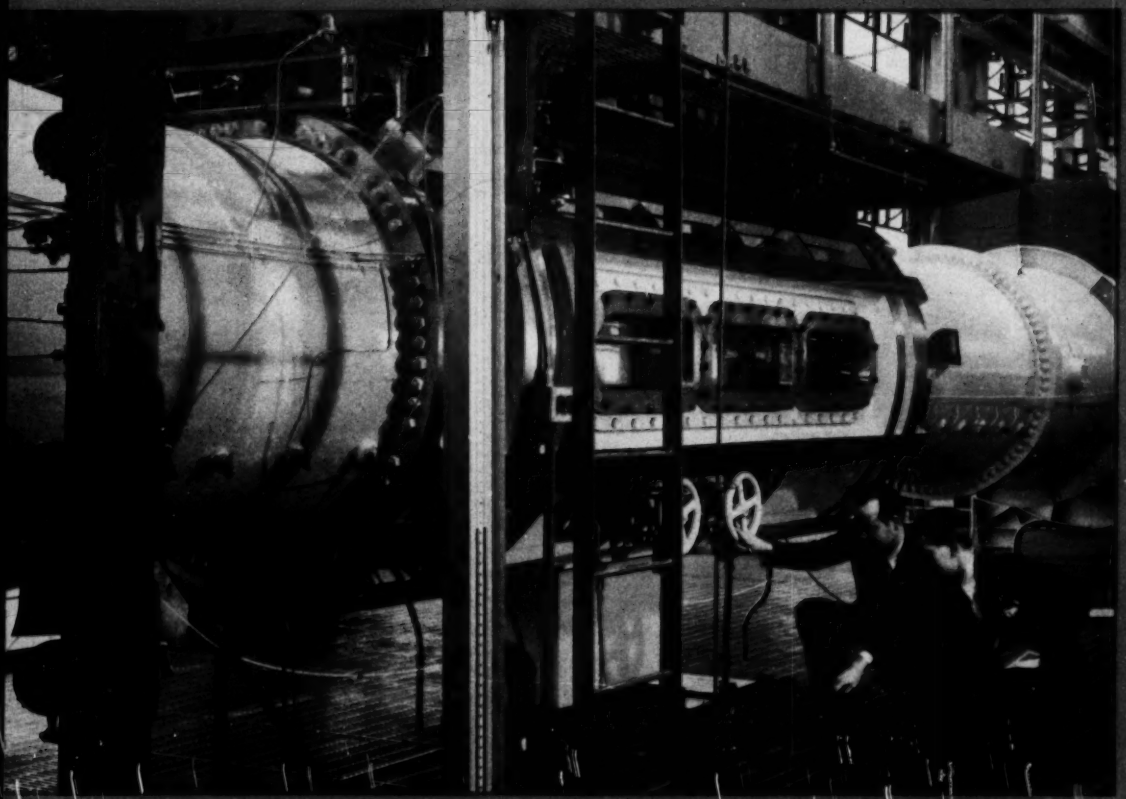
Heating Piping & Air Conditioning

DESIGN
INSTALLATION
OPERATION
MAINTENANCE

NOVEMBER ★ 1951

INDUSTRIAL
COMMERCIAL
INSTITUTIONAL AND
PUBLIC BUILDINGS

Page 113—Journal Section of The American Society of Heating and Ventilating Engineers



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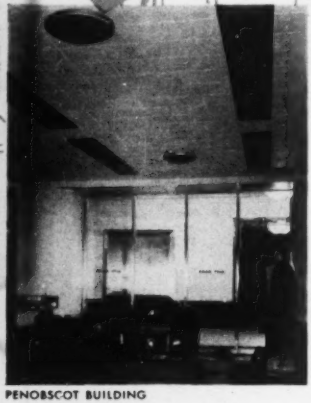
Aerofuse IN DETROIT

CLARK EQUIPMENT CO.

R. C. MAHON CO.

FORD MOTOR CO. (Dearborn)



PENOBSCOT BUILDING

In the city that symbolizes efficiency, it is not surprising to find that important air conditioning jobs are Aerofuse jobs. In many of Detroit's great automotive plants, modern office buildings, fashionable stores — where air conditioning has become an essential part of comfort — Aerofuse Diffusers have been specified for installation *at the vital point of air delivery.*

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GENERAL MOTORS TECHNOLOGICAL CENTER

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BRIGGS BUILDING, BIRMINGHAM

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NEW BRITAIN, CONNECTICUT

ENGINEERED PRODUCTS FOR AIR CONDITIONING, HEATING AND VENTILATING

1TB81

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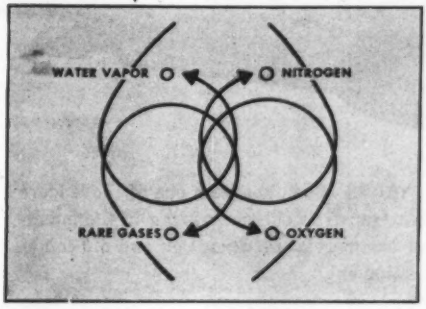

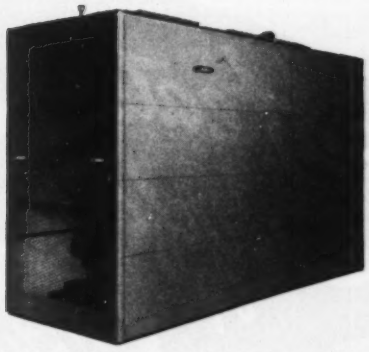

Refrigerated Kooler-aire contains compressor, conditioner and condenser in one package; requires only three simple connections. Handles everything from the simplest to the largest and most complicated air conditioning job.

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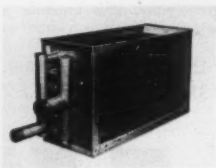
United States Air Conditioning Corporation
3300 Como Ave. S.E., Minneapolis 14, Minn.

Consult usAIRco

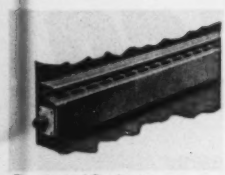
Red Cross Blood Donor Center, St. Paul, Minnesota. Special air conditioning system using usAIRco's R-K as installed by Pierre Aircon Company. Unit is placed in penthouse on roof.

Heating Surface by Bush

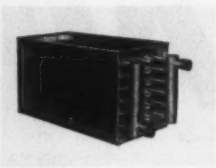
Convector



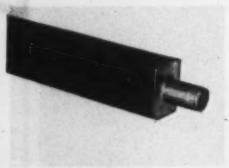
Steam Coil



Baseboard Radiation



Hot Water Coil



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Heating Piping & Air Conditioning

Vol. 23, No. 11

NOVEMBER 1951

(with which is merged the Aerologist)

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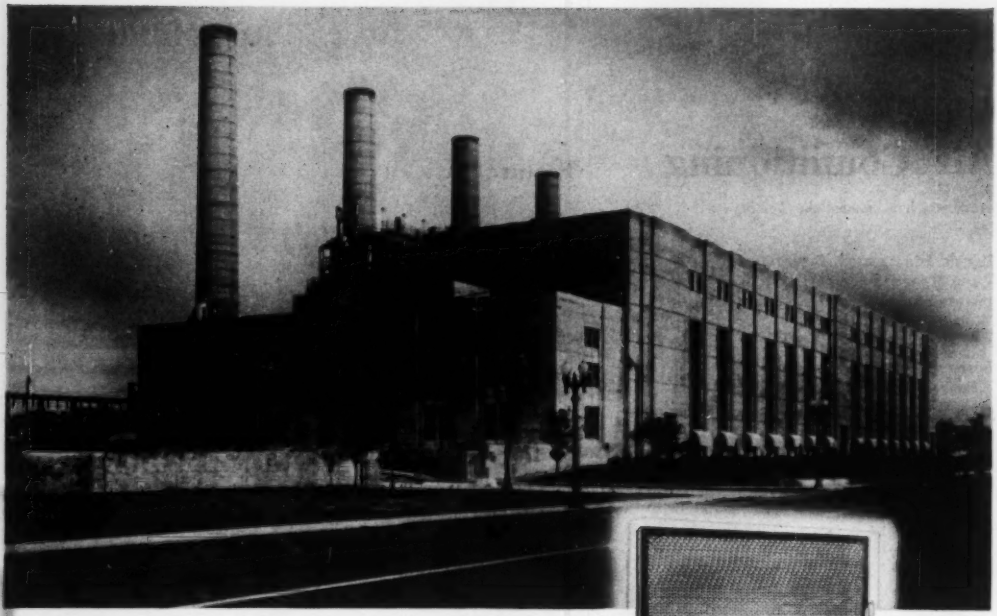

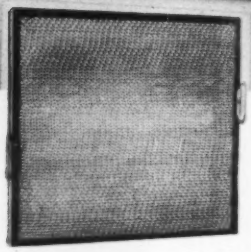

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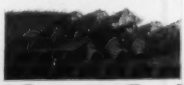

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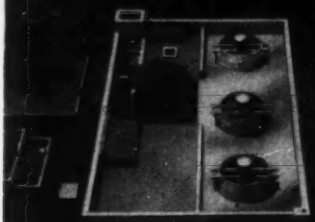
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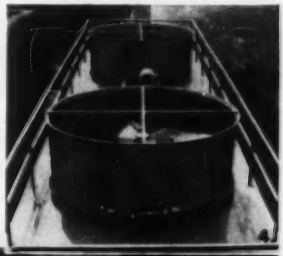
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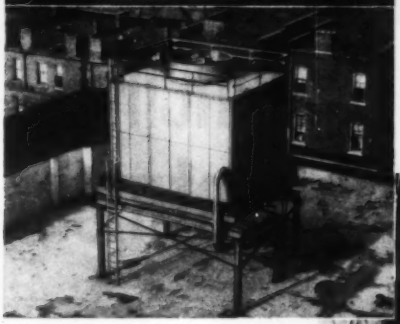
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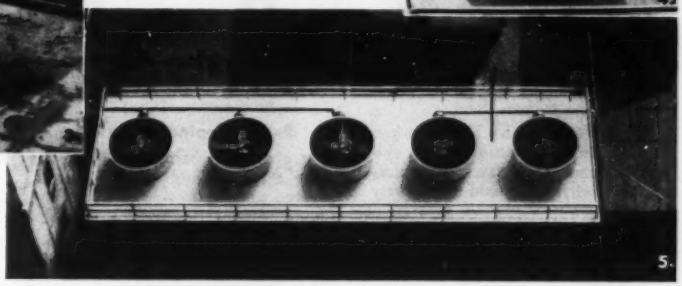
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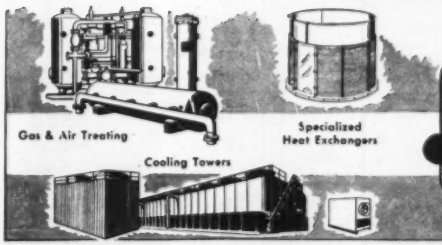

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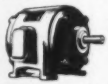

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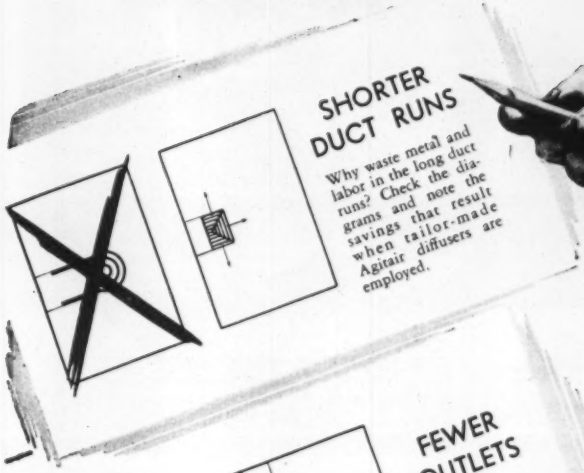

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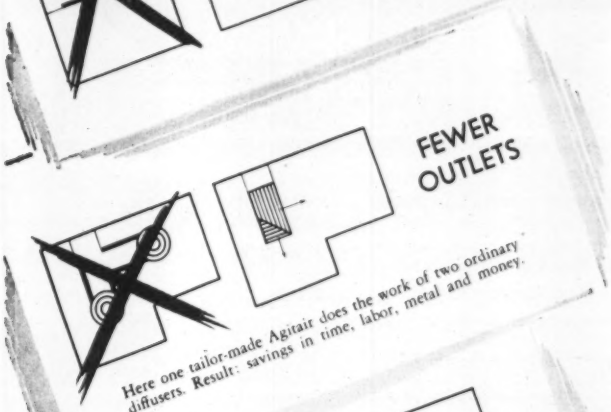

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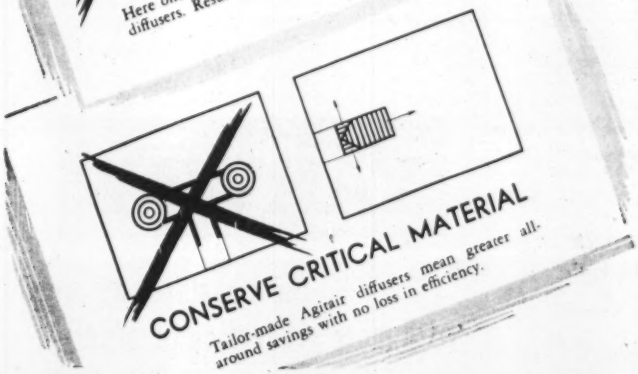

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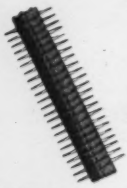

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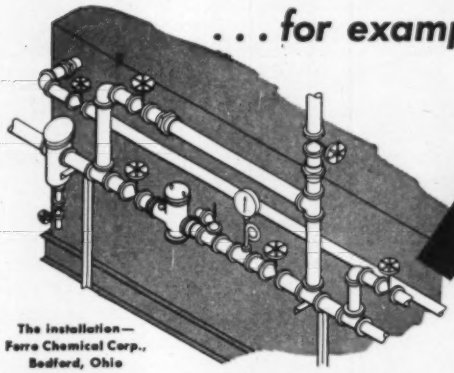
for outstanding service

on Steam to Drying Ovens . . . for example



The installation—
Ferro Chemical Corp.,
Bedford, Ohio

PROBLEM: To maintain automatically, within close limits, uniform reduced steam pressure from supply line to battery of two drying ovens controlled by individual thermostatic valves.

WORKING CONDITIONS: Initial steam pressure of 70 psi to be reduced to 13 psi, and maintained without significant fluctuation whether one, both, or neither of the ovens is being operated.

SOLUTION TO PROBLEM: One No. 960 Crane Brass Pressure Regulator, properly selected for capacity required, and with adequate condensate drainage provided.

RESULT: For more than 5 years, without interruption and with no more than routine maintenance, the Crane No. 960 Regulator has given complete satisfaction. Operating like new, and since all wearing parts are renewable, it will virtually never wear out. User remarks on unusual simplicity of adjustment.

Another typical case history, demonstrating the bigger value and lower ultimate cost of Crane Quality Valves. And why . . . More CRANE VALVES are used than any other make!

. . . Install Dependable Quality CRANE VALVES

No. 960 Crane Brass Pressure Regulator for steam or air. Literature on request through your Crane Branch or Crane Wholesaler.

CRANE CO.

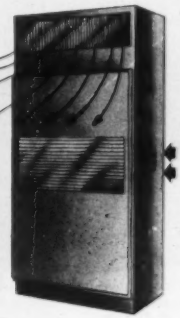
General Offices:
836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

Diaphragm Gas Valves
Preferred for their practical design, having automatic recycling manual operator, ease of installation and dependability, White-Rodgers diaphragm gas valves are quiet and smooth in operation. Also available without recycling manual operator. Two of many in the comprehensive line of White-Rodgers automatic controls for modern gas heating.
Catalog available on request.
WHITE-RODGERS
Controls
FOR REFRIGERATION HEATING AND AIR CONDITIONING

Now Garden-Fresh Air Everywhere with NO Mechanical Operating Costs!

RENOVAIR AIR DEODORIZER



RENOVAIR frees the air from even harsh paint and smoke odors, without perfume! And the RENOVAIR Gyrostatic Evaporator fits easily *inside* any air conditioning system or unit, and operates without an additional motor . . . reveals its presence only by the effect of garden-fresh air all the time! Simple to install . . . costs *nothing* to run!

MAINTAINS PLEASANT, PRODUCTIVE ATMOSPHERE EASILY, INEXPENSIVELY. Offensive odors can be costly . . . but RENOVAIR keeps air garden-fresh for only pennies a week! Clean, pleasant air by RENOVAIR will *attract* customers into stores and restaurants . . . keep employees happy and productive. Yet, RENOVAIR's foolproof Gyrostatic Evaporator installs easily, costs nothing to operate! RENOVAIR also performs perfectly from spray guns, fogging machines, or from the 12-ounce wick bottle for limited spaces.

NEUTRALIZES ODORS WITHOUT PERFUMING AIR— RENOVAIR uses non-toxic elements found in plant life —to neutralize indoor odors much the same as masses of green foliage freshen the air outdoors. *Contains no formaldehyde or chlorophyll* . . . will not burn, nor will it harm the sense of smell.

WHEREVER PEOPLE BREATHE RENOVAIR FILLS A NEED!

RESTAURANTS	THEATRES
STORES	BOWLING ALLEYS
WASHROOMS	HOTELS & APARTMENTS
HOSPITALS	OFFICES
SCHOOLS	INDUSTRIAL PLANTS

FOR LIMITED NON-AIR CONDITIONED SPACES

Use this Handy RENOVAIR WICK TYPE DEODORIZER

JUST PULL UP THE WICK . . .

enjoy garden-fresh air without perfume

12-oz. bottle only **79¢**

Get complete details FREE in this handy RENOVAIR folder! Contains full description of how *you* can eliminate costly odor problems with inexpensive RENOVAIR and RENOVAIR's Gyrostatic Evaporator. Mail coupon *today!*

Boyle-Midway Inc., Correctair Division
22 E. 40th St., New York 16, N. Y.
Cranford, N. J., Chamblee, Ga., Chicago, Los Angeles, Toronto

Boyle-Midway Inc., Correctair Division
22 E. 40th St., New York 16, N. Y.

Please send me your FREE RENOVAIR folder *at once!* I'm interested in further details.

Name_____

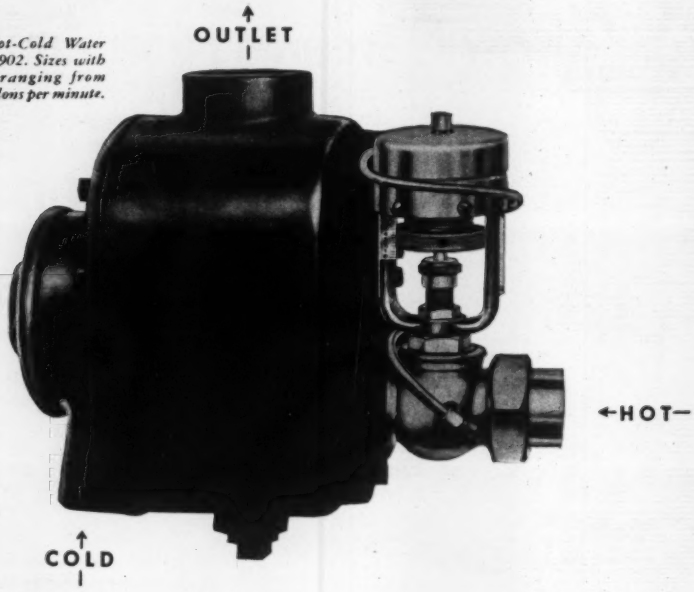
Firm_____

Address_____

City_____ Zone_____ State_____

SYLPHON CONTROLS FOR DEPENDABILITY

Sylphon Hot-Cold Water Mixer No. 902. Sizes with capacities ranging from 5 to 131 gallons per minute.



SPECIAL DELIVERY SYSTEM FOR *Constantly* HOT WATER!

Used in
Factories
Office Buildings
Apartment Houses
Hospitals
Schools
Hotels, etc.

for
Gang showers
Needle showers
Continuous baths
Wash fountains
Process water for packing houses, bakeries, dairies, garages, other industries

If you require constant temperature hot water for processing, showers and other operations—see what this thrifty, easily-installed Sylphon Hot-Cold Water Mixer can do to help you.

It uses hot water from any storage tank or instantaneous heater. It regulates the amount of cold water required to temper it to the desired degree. Water is actually mixed together before delivery. Temperature remains constant—even if supply water temperature or pressure fluctuates. Everything works automatically—dependably!

Here's an extra advantage. If either hot or cold water supply fails, the Sylphon Mixer immediately shuts off the remaining supply. When supply is returned, the Mixer starts operating again.

Sylphon Hot-Cold Water Mixers are self-contained, self-powered, ruggedly built. Adjustable temperature range. For complete information, write Department VH.

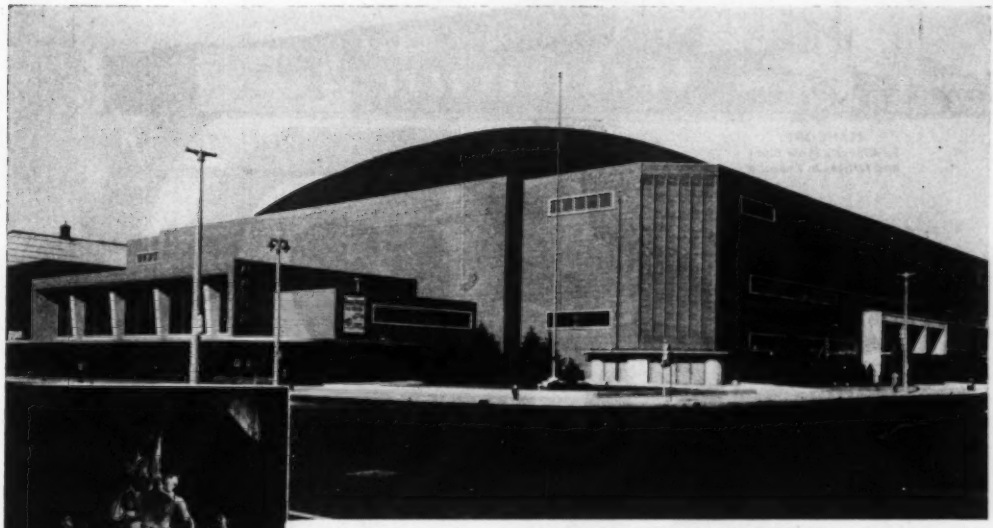
Temperature Controls • Bellows Devices • Bellows Assemblies

FULTON SYLPHON
DIVISION

FIRST WITH BELLOWS

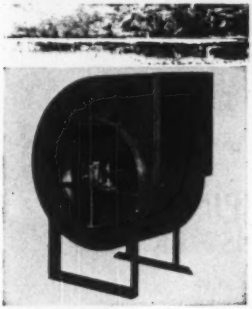
ROBERTSHAW-FULTON CONTROLS CO., KNOXVILLE 4, TENN

Canadian Representatives, Darling Brothers, Montreal



Milwaukee Arena, scene for sports, shows, conventions, exhibits and other public attractions. Eschweiler & Eschweiler, Architects, Jos. H. Volk, Htg. & Vtg. Engr. Downey Heating Co., Htg. & Vtg. Contrs.

Fans for Fans . . .



Aeroplex Ventilating Fan. Non-overloading, Type AP. Nineteen centrifugal fans like this one, in sizes from 15" to 73" wheel diameter, provide supply and exhaust ventilation for Milwaukee's Arena.

. . . breezes for rooters. Absorbed in the contest, few of the crowd in the Arena are aware of the many Bayley fans humming quietly at their steady jobs of blowing in fresh air, sucking out the stale. Nonetheless, spectators, participants and attendants all realize the value of good ventilation and appreciate its contribution to their comfort and enjoyment.

Yes, good ventilation plays an important part in pleasing the patrons. The fans chosen for this part must give a star performance every time, all the time. Such outstanding dependability is just one of the many reasons Bayley fans have been the choice for the Milwaukee Arena and other major ventilating or conditioning installations.

Over 50 years of experience in design and manufacture of air handling equipment back the confidence placed in Bayley products by architects, engineers, contractors and owners alike. Sound design, careful choice of materials and components, fine workmanship and other quality factors substantiate this faith in Bayley apparatus. Then too, there's the wide selection of standard types and sizes, as well as special designs for the unusual applications. That means just the right unit for the job, — no makeshifts. Top this off with expert Air Engineering service and you'll see why Bayley equipment is the best bet for satisfaction in air handling systems.

Bayley representatives are on call in principal cities. Why not call or write us about *your* requirements, and make *your* next job a Bayley One?

Bayley AIR HANDLING EQUIPMENT

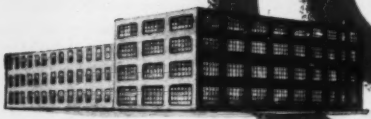
Performs better, — longer

BAYLEY BLOWER COMPANY

6400 W. BURNHAM ST. MILWAUKEE 14, WIS., U. S. A.

PLANT ONE
Tri-Clover's Main Plant and Offices in Kenosha

PLANT TWO
Kenosha



PLANT THREE
Fabricating Division Plant, Cudahy

PLANT FOUR
Another part of the Fabricating Division in Cudahy

WHERE YOUR CORROSION-RESISTANT PIPING PROBLEMS ALWAYS FIND THE RIGHT ANSWER

TRI-CLOVER offers over 30 years of specialized experience in solving corrosion-resistant piping problems for Industry. Skilled craftsmen and engineers in four completely equipped plants have made the name *Tri-Clover* on stainless steel and alloy fittings, valves, pumps, and specialties signify unexcelled performance.

Your selection of the *right* fitting valve, pump, tubing or pipe for the *right* job is made easier by Tri-Clover's complete production and engineering facilities. Benefit from this fact. For here is one dependable source . . . one responsibility for your piping problems.

Remember to specify Tri-Clover!

Tri-Clover®
MACHINE CO.
Kenosha, Wisconsin

TRIALLOY AND STAINLESS STEEL SANITARY FITTINGS, VALVES, PUMPS, TUBING, SPECIALTIES

FABRICATED STAINLESS STEEL INDUSTRIAL FITTINGS AND INDUSTRIAL PUMPS

THE Complete LINE

Carey duct

ALL-ASBESTOS AIR DUCT

QUIETS air movement

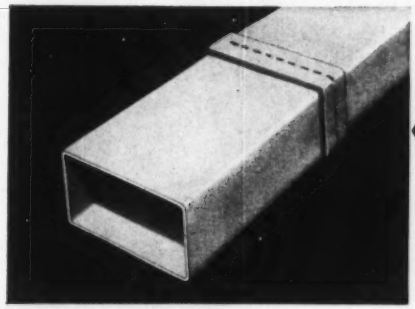
speeds up installation

Carey duct

CONSERVES CRITICAL METAL, TIME AND LABOR COSTS ...POSSESSES REVOLUTIONARY NEW ADVANTAGES!

Asbestos from core to cover, Careyduct is the *leading* choice of *leading* architects and builders because it offers a combination of advantages found in *no* other duct. It's light in weight, yet strong and rigid . . . low in cost, yet high in efficiency . . . goes up easily and fast, saves time and cuts cost!

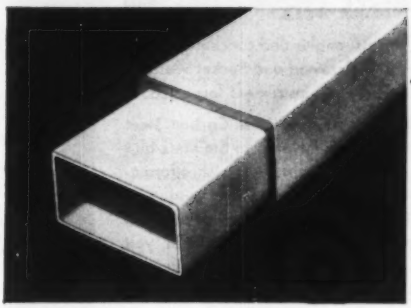
Careyduct is approved by Underwriters' Laboratories; cannot rot, rust or burn; is job-proved on important installations from coast to coast. Order it in standardized prefabricated sections for slip-joint assembly in *two* all-purpose forms!



1 Single Wall Careyduct

FOR WARM AIR HEATING SYSTEMS

"SW" Careyduct hushes pops, groans and creaks that "telegraph" through ordinary metal ducts during furnace "on" and "off" periods. Its insulating properties conserve fuel, speed furnace-to-room heat up time. "SW" Careyduct is also ideal for cold air returns and ventilating conduits. The 3′ prefabricated sections are joined by a collar, similar in texture and thickness to the duct itself.



2 Insulated and Acoustical Careyduct

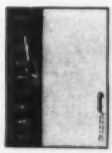
FOR AIR CONDITIONING SYSTEMS

"I&A" Careyduct "soaks up" sound . . . hushes air noise . . . absorbs fan *rumbles* and *grumbles* . . . makes possible whisper-quiet air conditioning systems in new buildings or old. "I&A" Careyduct handles air velocities up to 2500 feet per minute; permits installation of smaller ducts where space is limited. The 3′ sections are designed for rapid, trouble-free installation with ordinary tools.

*Under Union jurisdiction, Careyduct is installed by the Sheet Metal Trades.

Both types of Careyduct come in a range of sizes from 2½" x 5½" to 23½" x 23½" in width, and in special sizes up to 17½" x 35½". Also in round sections from 3" to 30" in diameter. And in a complete range of standard fitting accessories.

Get the full story! Learn how you can save metal, time and manpower . . . improve your profit picture, too! Phone your Carey representative, or send for your free copy of our new Careyduct Manual. No obligation!



Carey.

The Philip Carey Mfg. Co., Lockland, Cincinnati 15, Ohio

STILL YOUR BEST BUY...

Where pipes meet permanently...

W-S FORGED FITTINGS

in CARBON, ALLOY and STAINLESS STEELS

. . . Still your best buy, because W-S longer service life and increased dependability give that permanency which will lower maintenance costs . . . They are drop forged.

Basic materials are selected from a wide choice of carbon, stainless and alloy steels and then subjected to the most exacting metallurgical controls from melt to bar. Through these precautions and subsequent precision machining operations, W-S assures the utmost in accuracy of finish, perfection of threads, sockets, angles and concentricity. All W-S Fittings, — Screwed and Socket Welding Types, — are finally instrument inspected.

W-S Bulletin A3-50 details the Carbon Steel Line. Bulletin S-1 is devoted to Stainless and the Alloys. W-S will gladly furnish information on the new FEATHERLITE Fittings — a recent big step in a wide range of services. Write today for the specific bulletin you desire.

Sold Through Leading Distributors

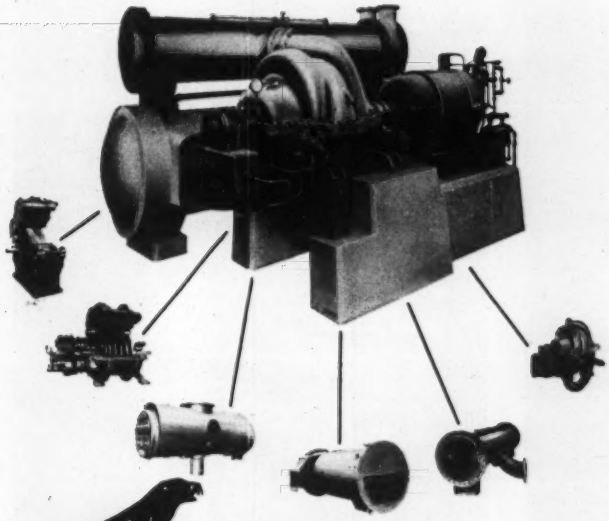
9-L-2

DISTRIBUTOR PRODUCTS DIVISION

WATSON-STILLMAN

Established 1848

ROSELLE, NEW JERSEY



Where do you get

UNDIVIDED RESPONSIBILITY

in an installation of centrifugal refrigeration?

Worthington will "wrap up a package".

Unlike other manufacturers of air conditioning and refrigeration equipment, Worthington *makes*—not just assembles—all the major components for each installation.

Compressor, condenser, cooler and such drive equipment as steam turbines, steam condensers, motors, and step-up gears—are all made in Worthington's own plant—each carefully designed for balanced operation with its companion components.

So the builder and owner can place full responsibility on the one supplier —Worthington.

Worthington centrifugal systems are used with most refrigerants and for any process—chilling water, brine, chemicals, lubricating oils—for temperatures as low as minus 160 F, capacities from 150 to 2600 tons.

A typical Worthington compressor feature is the arrangement of the volute passages and impellers to counterbalance the radial and axial thrusts, respectively, in the various stages.

Write for Bulletin C-1100-B14 on Worthington centrifugal refrigeration.

Worthington room conditioners for both heating and cooling are built to operate with chilled water or direct expansion cooling, capacities from 350 to 600 cfm for under-window installation.

PACKAGE UNITS SELECTED TO COOL HUGE OFFICE BUILDING

This is an excellent example of how Worthington's complete line makes it possible to select exactly right equipment.

The new office building at 488 Madison Avenue, New York—home of many famous magazines and large industrial firms—is air conditioned primarily by package units, assisted by a Freon-12 reciprocating system with chilled water and steam coils.

Purpose of using package units in a big building like this is to provide for a variety of conditions imposed by both the building and the type of tenants: air conditioning needed only on top floors during certain seasons, difference in sun load on various sections, certain tenants working late hours but only with skeleton forces.

Second through 20th floors are handled by 38 Worthington 20 and 25 ton Package Air Conditioners, two per floor. Basement, first floor and top three floors are handled by two Worthington 75-ton Freon-12 compressors complete with condensers, pumps, water coolers and five central station units with chilled water and steam coils. Total capacity is 1050 tons.

Builders and owners: Uris Bros. Consulting engineer: Henry Oehrig. Air conditioning contractor: Raisler Corp. Architects: Emory Roth & Sons. All of New York.

RICE HOTEL MULTIPLIES COMFORT-COOLING WITHOUT REQUIRING MORE ROOM

Last year, Houston's Rice Hotel completed air conditioning its entire building, including a thousand guest rooms, dining rooms and meeting rooms, by installing three Worthington 600-ton centrifugal chilled water systems.

This equipment, utilizing Freon-11, replaced ammonia refrigeration equipment having a capacity of 350 tons, yet occupies no more space than formerly.

Worthington equipment was selected primarily because Worthington could provide 100% equipment of its own make. The compressors are driven by Worthington steam turbines and steam condensers.

Engineer: Reg. F. Taylor. Mechanical Contractor: Charles G. Heyne & Co. Architect: Kenneth Franzheim. All of Houston.

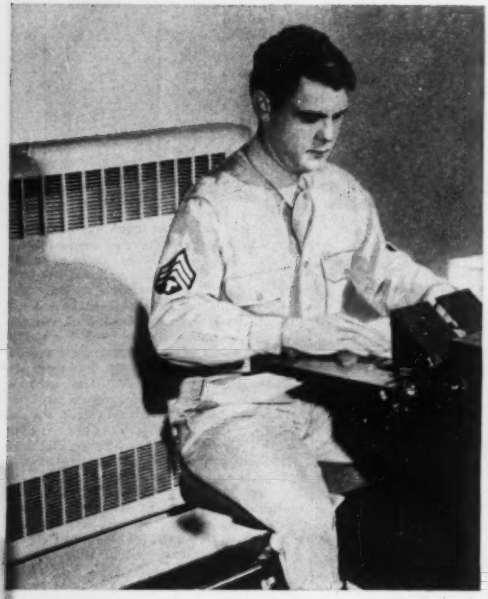
WORTHINGTON

AIR CONDITIONING AND REFRIGERATION

INVESTIGATE

MORE WORTH WITH WORTHINGTON

Consult Classified Telephone Directory for nearest Worthington distributor. Worthington Pump and Machinery Corporation, Air Conditioning and Refrigeration Division, Harrison, N. J., specialists in air conditioning and refrigeration for more than 50 years. A-1-2



Military Bases . . . Essential Industries . . . Defense Housing . . . Schools and Hospitals

Matched Trane Products Serve National Defense Everywhere

Matched Trane Products are completely coordinated for selection, installation and operation together. An infinite number of combinations can be easily fitted together to form the most suitable type of system for each individual heating, ventilating, cooling or air conditioning problem.

Military Bases—Buildings by the thousands from smallest chapel to the mighty Pentagon, need heating in one form or another. Trane Convectors team up with Trane Steam Specialties, Unit Heaters, Heating Coils, Fans and Wall-Fin to create just the right conditions in military bases everywhere.

Essential Industry—Critical dimensions and critical worker efficiency have to be kept under close climate control in the manufacture of munitions. Trane Reciprocating Compressors combine with Trane Climate Changers to hold close tolerances and make men efficient.

Defense Housing—Easy-to-install economical heating units required for multiroom projects. Trane Convectors matched with Trane Hot Water Products provide sparkling warmth for hundreds of housing projects so vital to the defense program.

Schools—The right combination of ventilating and heating is a must in modern education—Trane Unit Ventilators provide clean, fresh tempered air—Trane Convectors, the supplemental heating in countless schools and colleges.

Hospitals—Correct humidity and temperatures are essential in the hospital operating room to speed the surgeon and protect the patient. The new Trane Operating Room Air Conditioner fits in conveniently to furnish the exact conditions required.

Whatever your heating, ventilating, cooling or air conditioning problem is, look for the answer in the Trane line.

This housing project contains almost a thousand Trane Convectors in addition to Trane Trap Valves and Pumps.

The Merle Abbot School – so successful was the first installation of Trane Unit Ventilators that more were ordered for a new addition.

Trane Air Conditioning equipment tucked into an out-of-the-way corner is used to cool the twin operating rooms in this hospital.

TRANE

MANUFACTURING ENGINEERS OF HEATING, VENTILATING AND AIR CONDITIONING EQUIPMENT

THE TRANE COMPANY, LA CROSSE, WIS.
Eastern Mfg. Division . . . Scranton, Pa.
Trane Company of Canada, Ltd., Toronto

OFFICES IN 80 U. S. AND 14 CANADIAN CITIES

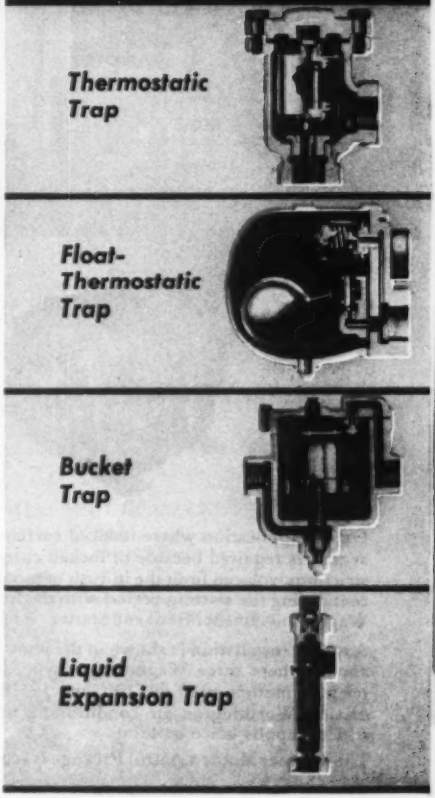
WOULD YOU PLAY A TOURNAMENT *with one club?*

But on the golf course you can see the results. In steam hook-ups on the other hand, bad performance may go undetected for years, even though the traps apparently are working properly.

If you are in competition, it is certain that you cannot get the lowest fuel costs and highest production rates from steam heating and process equipment by "standardizing" on one type of steam trap for all purposes in your plant.

The four principal types of Sarco steam traps are illustrated at the right. They are available in a wide range of sizes and steam pressures and each has a specific function. The trick is to get the right trap on every steam job and every steam line in your plant. This can be done by calling in the Sarco Representative near you, or by asking for Sarco Catalog No. 1600 which gives recommendations for trapping all kinds of equipment, both indoors and out.

STEAM TRAPS ARE LIKE THAT...

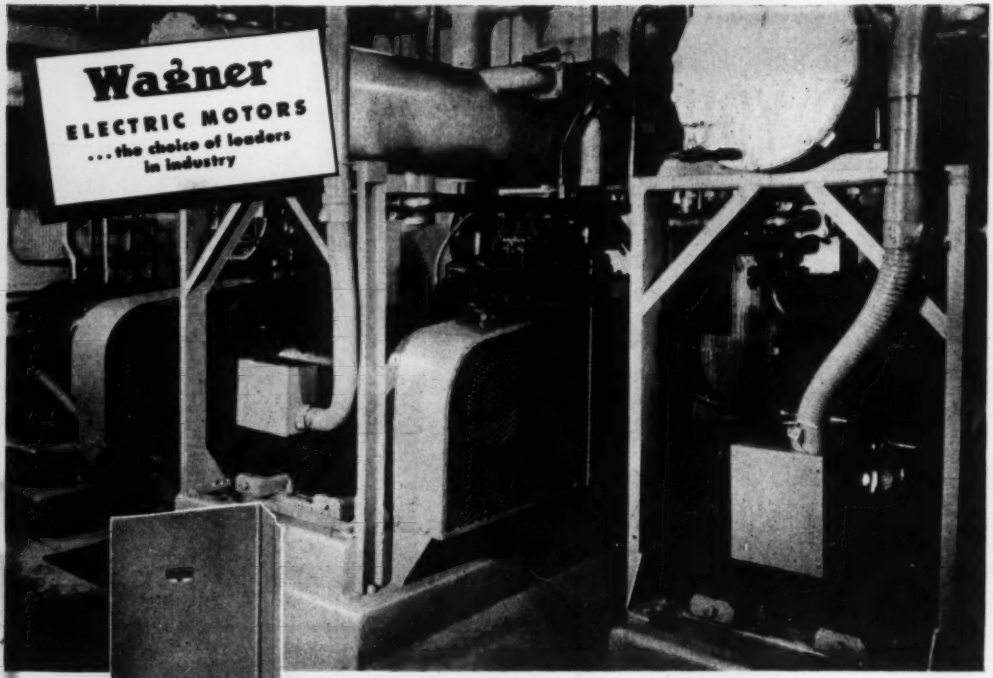


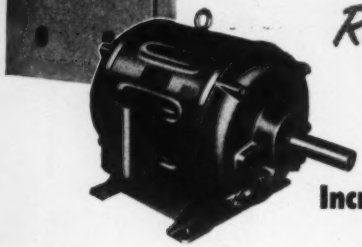
312

SARCO SAVES STEAM

SARCO COMPANY, INC.
Represented in Principal Cities
Empire State Building, New York 1, N. Y.
SARCO CANADA, LTD., TORONTO 5, ONTARIO

IMPROVES PRODUCT QUALITY AND OUTPUT





Reduce starting current draw

the economical way with the Wagner Increment Motor and Starter Combination

On any application where reduced current draw at start is required because of locked current restrictions, you can limit the in-rush of motor current during the starting period with the low cost Wagner Increment Motor and Starter "Package."

A typical installation is shown in the photograph above, where three Wagner open-type general purpose motors rated 60, 100, and 125 hp are driving Worthington air conditioning units in a Minneapolis office building.

The Wagner Motor-Control Package is economical to install and permits the use of high grade magnetically operated control equipment at a low purchase price. For special requirements, the motor-control combination can be furnished with Wagner normal or high torque explosion-proof motors, splash-proof motors, or totally-enclosed fan-cooled motors as well as with the open type motor.

Why not investigate this Wagner combination today? Write for full information, or consult the nearest of Wagner's 31 branch offices, located in all principal cities.

WAGNER ELECTRIC CORPORATION
6370 Plymouth Ave., St. Louis 14, Mo., U.S.A.

ELECTRIC MOTORS · TRANSFORMERS · INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS – AIR AND HYDRAULIC

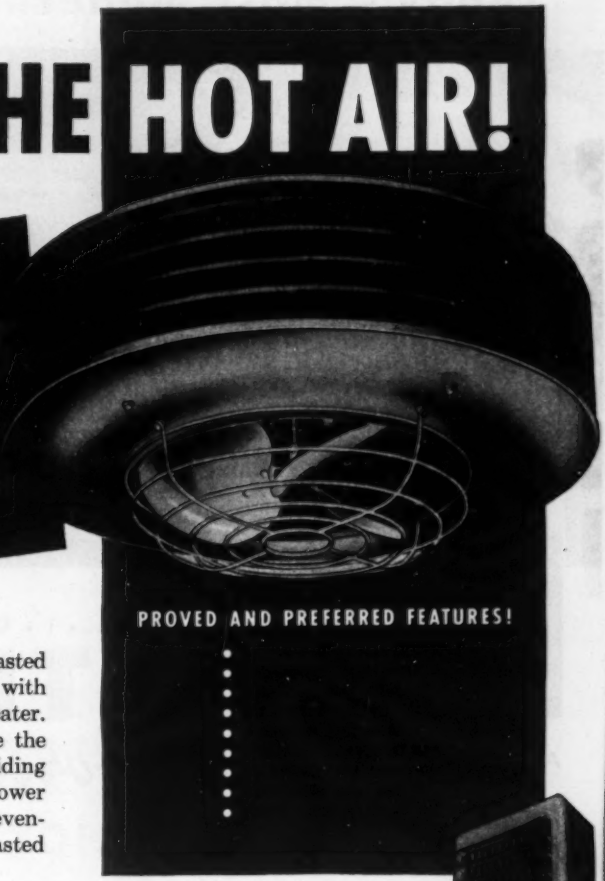
BRANCHES IN 31 PRINCIPAL CITIES

®Wagner Electric Corporation
1891 1951

M51-17

SAVE THE HOT AIR!

McQuay DOWN FLOW UNIT HEATERS



PROVED AND PREFERRED FEATURES!

Save the hot air ordinarily wasted in buildings with high ceilings with a McQuay Down Flow Unit Heater. These vertical unit heaters have the famous Ripple-Fin Coils—providing peak heating efficiency—will lower your heating costs by circulating evenly and gently this normally wasted stratified air.

There are 22 Down Flow Units available to meet your exact requirements. Capacity range from 25,400 to 500,000 Btu per hour. Four styles of directional air diffusers are available to provide any desired air distribution.

Consult the McQuay representative in your city, or write McQuay, Inc., 1601 Broadway St. N.E., Minneapolis 13, Minnesota.

HORIZONTAL UNIT HEATERS

These unit heaters are offered for normal applications where horizontal air flow is desired. In 24 sizes with capacities ranging from 20,300 to 360,000 Btu per hour.

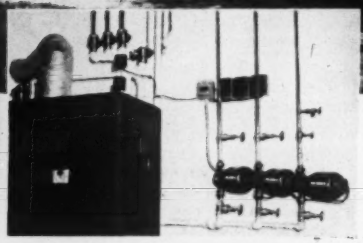
BLOWER TYPE UNIT HEATERS

For effective heat distribution over large open areas. Available in 8 sizes . . . in suspended and floor models, with one and two row coils; capacities from 20,600 to 1,600,000 Btu per hour.

McQuay INC.

HEATING • AIR CONDITIONING • REFRIGERATION

Today's most modern homes . . .



. . . are heated with THRUSH *forced circulating* HOT WATER HEAT

A SIMPLE ZONED SYSTEM

Notice the compactness of this three-zone Flow Control System and the inexpensive units used. Just a Circulator, a Flow Control Valve and a No. 201 Radiant Heat Control in each zone. There are no costly motorized valves no complicated devices to give trouble. Temperature in each zone is maintained automatically.

HERE'S a beautiful new home heated economically with forced circulating hot water, with radiant coils in the ceiling providing completely automatic radiant heat in any weather. Thrush Flow Control System of Forced Circulating Hot Water Heat assures highest efficiency . . . uniform temperatures in every room . . . with no overheating. Room temperature is controlled within a fraction of a degree separately in each of the three zones. This is the heating plant your customers want. See your wholesaler today or write Dept. E-11 for more information.

Horizontal Water Circulator

Vertical Flow Control Valve

Ask for folder on Thrush Forced Circulating Flow Control System of Hot Water Heating.

H. A. THRUSH AND COMPANY PERU, INDIANA

BRUNNER SINCE 1906 REFRIGERATION helps you serve better

There are just two steps to closing more business

THE FIRST STEP IS—*use this coupon*

Just fill it in and mail it

We will know this is your request for a Brunner factory representative to stop in and go over the reasons why Brunner dealers find it easier to close business.

Name

Company

Address

City and State

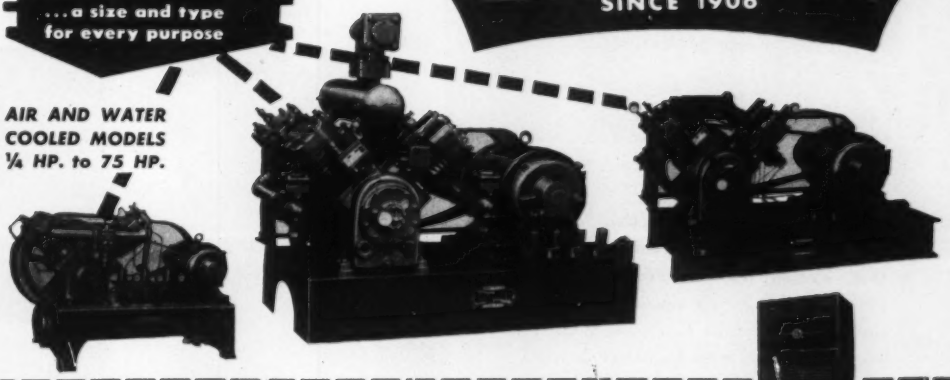
With all the facts fresh in mind you will recognize the second step—recommend and install Brunner's from now on. With 69 models comprising a complete range of commercial capacities and types, a dependable source of supply and a known product with ready acceptance by your customers, selling obstacles are removed and you are on the way to bigger business. We will be looking for the coupon.

BRUNNER MANUFACTURING COMPANY
Utica 1, New York, U. S. A.

REFRIGERATION CONDENSING UNITS
...a size and type for every purpose

BRUNNER SINCE 1906

AIR AND WATER COOLED MODELS ¼ HP. to 75 HP.

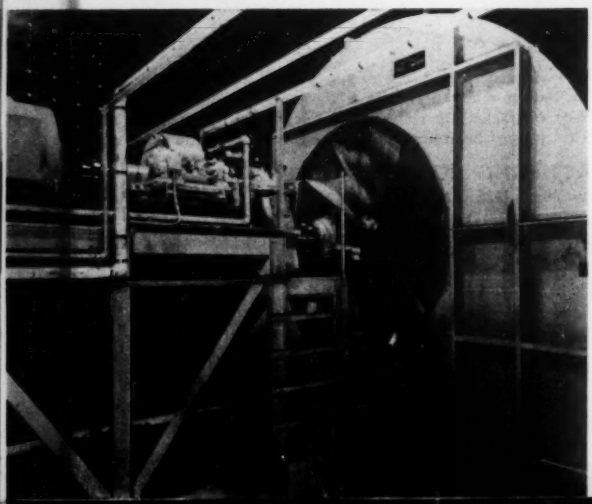


BRUNNER SINCE 1906

AIR CONDITIONING
Self Contained Units in 4 sizes: 3-5-7½ and 10 HP.
Remote Installation Types from 3 to 75 HP.

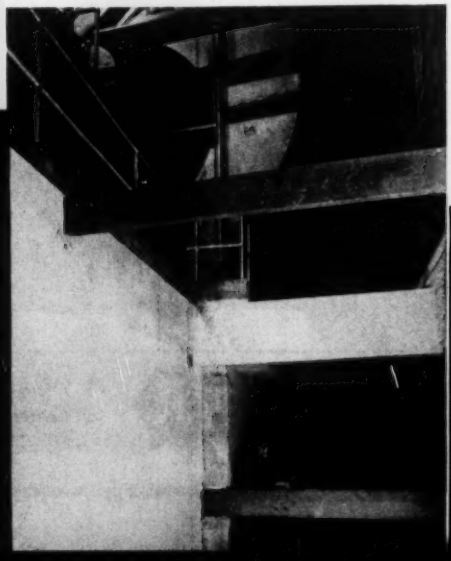
GIVE AIR A *Fast*

— as KAUFMANN'S SHOPPERS ENJOY "RESORT" CLIMATE IN ALL 13 STORIES OF PROMINENT PITTSBURGH STORE



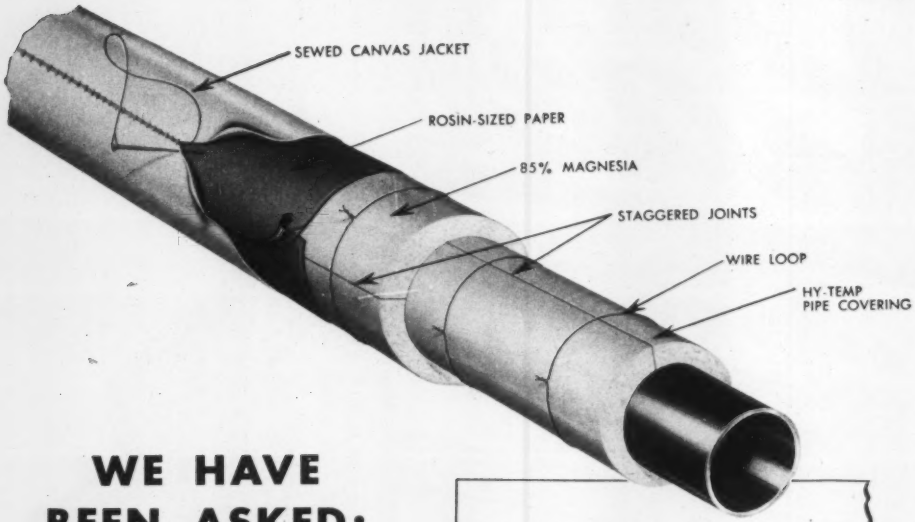
DELIVERING 15 TONS OF AIR EVERY MINUTE!

The first air conditioning installation utilizing the high duct velocity principle for large interiors. More air thru smaller ducts at faster speeds saves space and money. Designed and installed by The Carrier Corporation, this installation is already highly regarded in the department store field.



Ride

"Buffalo" CAN SOLVE YOUR AIR PROBLEM!



WE HAVE BEEN ASKED:

"What insulation do you recommend for a superheated steam line which operates at 1000° F.?"

"We are installing a 5" superheated steam line and plan to finish it with sewed canvas and paint to match existing lines," writes a power engineer. "What insulation do you recommend on a line like this?"

An efficient method of insulating this line would be a combination of Hy-Temp and 85% Magnesia Covering, each layer being 2" thick. Both layers of insulation should be applied with horizontal and vertical joints staggered so that there are no through joints where heat might escape. On high-temperature lines, this is important as it eliminates the possibility of heat's leaking through and burning the finish. Staggered joint construction also does away with the danger of fire in places where solvent fumes or other hazards are encountered.

With this construction, the layer of Hy-Temp Covering is applied first. This reduces the temperature at its outer surface to 600° F., the top temperature limit of the 85% Magnesia that is then applied to reduce heat loss further.

On many heat insulation jobs, there are places where proper application of materials can prevent burning of the finish, eliminate a fire hazard, or solve any one of dozens of other problems. Armstrong engineers can recognize those places before the insulation is applied and make the recommendations that will stop trouble before it occurs. The complete contracting service Armstrong offers also brings you top-quality materials and skilled workmen to apply them. The next time you have any insulation work to be done, it will pay you to get in touch with this reliable contractor.

SEND US YOUR QUESTIONS: If you have any questions on the use or application of either high- or low-temperature insulation, please do not hesitate to write us. We'll do our best to give you a practical answer. Just address a letter or post card to Armstrong Cork Company, 4411 Maple Avenue, Lancaster, Pennsylvania.

ARMSTRONG'S INDUSTRIAL INSULATIONS

Engineers rate Modine the standard of excellence

COMPARE

ON EVERY COUNT
MODINE UNIT HEATERS STAND OUT

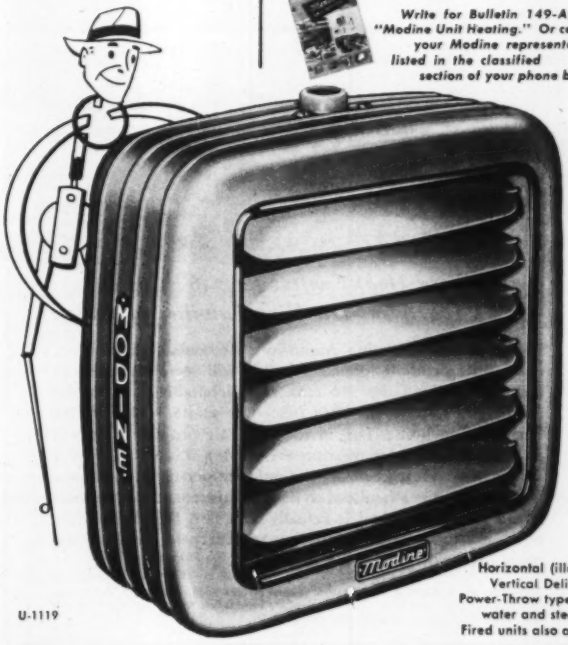
Compare performance! Modine's balanced combination of discharge air temperatures, velocity and volume give you perfect heating comfort.

Compare economy! Fuel bills are smaller with Modine because heat is delivered where it's needed — not wasted at the ceiling. And installation and maintenance costs are far lower, too.

Get all the facts from your Modine representative. *Compare first* — and you'll choose Modine. Modine Mfg. Co., 1509 DeKoven Ave., Racine, Wis.

Modine UNIT HEATERS

Write for Bulletin 149-A, "Modine Unit Heating." Or contact your Modine representative listed in the classified section of your phone book.



Horizontal (illustrated), Vertical Delivery and Power-Throw types for hot water and steam. Gas-Fired units also available.

U-1119

Discharge air temperatures of 110°-120° F. are correctly related to air velocities—assure perfect heating comfort plus lower fuel costs.

Sound-silencing features assure quieter operation—certified by accurate laboratory sound ratings. Especially important for commercial and institutional use.

Sturdy, steel, integral fan guard offers safety from exposed fan — serves as a resilient, vibration-absorbing mounting for the unit's motor.

Do you know how ships help you have better temperature controls ashore?
Why do "Coordinated Classrooms" make students learn faster?
How does temperature control help give babies a better start in life? Read about it in . . .

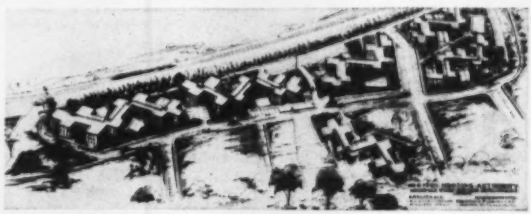
Your Progress Report from

MINNEAPOLIS
Honeywell

U. S. S. Independence

New U. S. Liners "Test" Controls at Sea

The toughest use-test temperature controls have to face is found aboard ship. Here controls must give a sensitive, accurate performance in the face of vibration, shock and corrosive salt-air conditions. Experience gained in making sea-going controls expands the knowledge of Honeywell engineers, helps them design controls that give a better, more satisfying performance on land. The wide range of control applications ashore that benefit from sea-testing is demonstrated by the many types of controls used aboard American Export Lines' fabulous new sister ships "Independence" and "Constitution." Honeywell thermostats on the liners provide individually controlled comfort in every stateroom. And throughout the ships—in lounges, cargo holds, engine rooms—there are hundreds of other automatic controls. All of these long-lasting controls for heating, ventilating, air conditioning and refrigeration are built by Honeywell.



Personalized Heat Control for 336 Apartment-Dwelling Families in Boston

In the Boston Housing Authority's Archdale Road Project, now nearing completion, three boilers will serve the six buildings. But each of the 336 tenants will be able to enjoy the room temperatures he likes best—just as he would in the finest private home. For, in the Archdale project, there will be a Honeywell thermostat on every living room wall. This is Personalized Heat Control—the only temperature control system that permits a landlord to keep *all* his tenants comfortable at the same time. And it actually *saves* him fuel, because he never has to overheat a building to satisfy the few who demand higher-than-average temperatures.

Architect: M. A. Dyer & Co., Boston; Engineers: Hayden, Harding & Buchanan, Boston; Heating Contractor: T. G. Gallagher, Somerville, Mass.; General Contractors: Jefferson Construction Co., Cambridge.

Massachusetts Hospital has Air Conditioned Nurseries, Individually Controlled Room Temperatures

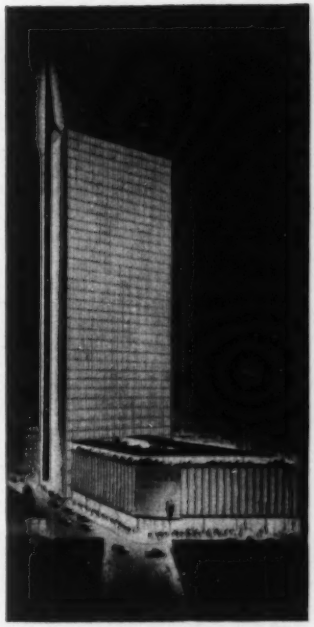
Most medical authorities agree that rigidly controlled room temperatures are needed to give new babies maximum protection. That's why Lowell General Hospital will have Honeywell temperature and humidity controls in the nurseries, labor, delivery and operating rooms of the new maternity and pediatric building. Moreover, to help bring mothers back to normal faster, each bedroom will have Honeywell Individual Room Temperature Control—the only practical way to compensate for effects of wind, sun, open windows and variations in occupancy in hospitals.

Architects: James H. Ritchie & Associates, Boston; General Contractor: Daniel Cunningham Construction Co., Inc., Boston; Mechanical Engineers: C. E. Doucette, Boston; Mechanical Contractor: J. J. Hurley Co., Boston.

40 Stories of Comfort in Southwest's Largest Building

When the Republic National Bank's impressive new home is completed in Dallas sometime next year, every room will have the wonderful kind of comfort offered by Honeywell Individual Room Temperature Control. This system compensates better than any other for effects of wind, sun, temperature and variations in internal load. It makes sure occupants always receive exactly the right amount of warm or cool air needed for comfort—no matter what the Dallas weather. Room thermostats in the new bank will be pneumatic. And, of course, all other controls needed for year-round air conditioning will be supplied by Honeywell. Instruments will be furnished by Honeywell's Industrial Division.

Architects: Harrison & Abramovitz, New York; Assoc. Architects: Gill & Harrell, Dallas; Consulting Engineers: Jaros, Baum and Bolles, New York; Assoc. Consulting Engineers: Zumwalt & Vinther, Dallas; General Contractors: J. W. Bateson Co., Inc., Dallas; Mechanical Contractors: The Farwell Co., Inc., Dallas.



New Jersey Classrooms "Coordinated" for Faster Learning

What determines how fast a child learns? Inborn capacity, of course. *And* classroom conditions—according to recent large-scale experiments. These tests showed that in "Coordinated Classrooms"—rooms where seating, lighting, noise level, heating and ventilating are properly controlled—students of all I. Q. levels make greatly improved progress. Shown above is a new Cedar Grove, N. J., elementary school, all nine rooms of which will be "coordinated." To keep room temperatures uniform and air properly fresh, Cedar Grove officials chose simple, accurate Honeywell controls.

Architect: Alfonso Alvarez, Jr., Upper Montclair, N. J.; Engineers: Vogelbach and Baumann, Jersey City, N. J.; Heating Contractor: Albert F. Ruehl Co., Newark, N. J.

For additional information on any of the installations, products or systems mentioned in this report, call your local Honeywell office. Or fill in the coupon below and mail it to us *today*.

Minneapolis-Honeywell
Dept. HA-11-192, Minneapolis 8, Minn.

Gentlemen: Please send me further information on

- ☐ Marine controls
- ☐ PHC for apartments
- ☐ Heating and air conditioning controls for large buildings
- ☐ Hospital heating and air conditioning controls
- ☐ Temperature controls for schools

*Name*_____

*Firm Name*_____

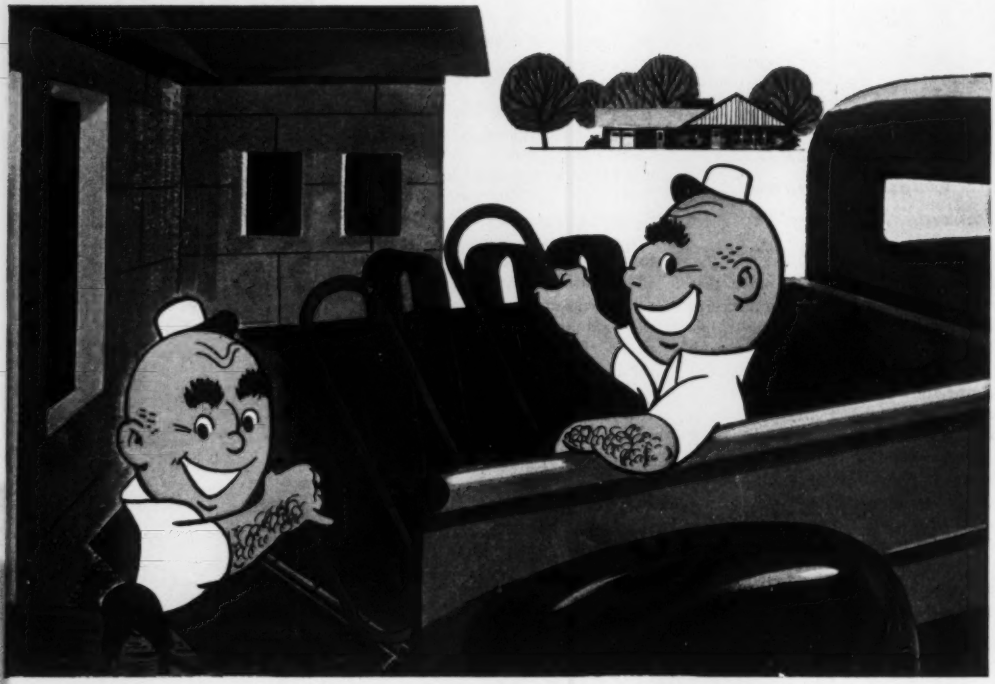
*Address*_____

*City*_____

*Zone*_____ *State*_____

MINNEAPOLIS **Honeywell**

First in Controls



Better radiant heating systems start with Bundyweld Tubing

Bundyweld Tubing performs better in your systems, cuts waste, saves time in fabrication, too.

It stands alone, the only tubing double-walled from a single strip, with an exclusive beveled seam-edge. It's copper-brazed through 360° of wall contact into a smoother, stronger, solid-wall tube that spells leakproof, efficient radiant heating systems right from the start.

Bundyweld comes to you in twenty-foot lengths with one end expanded if specified. It fabricates quickly, easily at your shop or building site. No kid-glove handling; it's ductile, yet extra-strong. One man easily forms Bundyweld on a simple bending fixture. Just two men quickly position the lightweight, rigid grids.

Check your *Sweet's Architectural File* or write us now for more detailed information. Though defense tubing requirements get first call, we'll do our best to fill your needs. ***Bundy Tubing Company, Detroit 14, Michigan.***

Bundyweld® Tubing

DOUBLE-WALLED FROM A SINGLE STRIP

WHY BUNDYWELD IS BETTER TUBING

Bundyweld starts as a single strip of basic metal, coated with a bonding metal. Then it's . . .

continuously rolled twice around laterally into a tube of uniform thickness, and

passed through a furnace. Bonding metal fuses with basic metal, presto—

Bundyweld . . . double-walled and brazed through 360° of wall contact.

NOTE the exclusive patented Bundyweld beveled edge, which affords a smoother joint, absence of bead and less chance for any leakage.

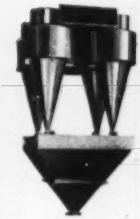
American Blower—a time-honored name in air handling

Venturafin
Unit Heaters

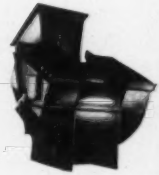
Type TM
Gyrol Fluid Drives

Utility Sets

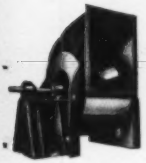
Ventura
Ventilating Fans



Dust Collectors



Mechanical
Draft Fans



Industrial Fans

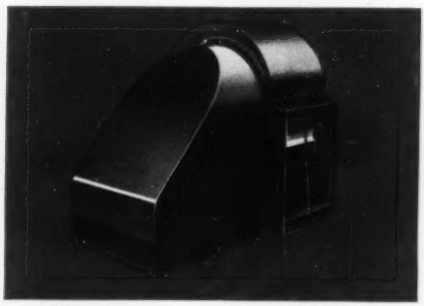
Heating and
Cooling Coils

Air Conditioning
Equipment

There's a big difference in quality, design, quietness, operating costs and efficiency between American Blower and ordinary air handling equipment. It pays to look before you buy! Comparative tests by buyers have thoroughly proved the superiority of American Blower Air Handling Equipment.

In Boston, as in other cities, American Blower Air Handling Products have been serving commerce, industry and public utilities for over half a century. For air handling data in the Boston area, call American Blower—Liberty 2-8427. In other areas, consult your phone book.

Product of the month



American Blower Utility Sets are available in a wide range of sizes and capacities. Write for Bulletin 2814.

American Blower Utility Sets for good ventilation

Present-day standards call for good ventilation in schools, apartment houses, restaurants, stores and hospitals as well as in industrial plants.

So we'd like to suggest that now is a good time to investigate the advantages of American Blower Utility Sets.

The Utility Set is ideal for general ventilation where duct systems are required. It can be used as a supply or exhaust fan and is equipped with Aileron Control for regulation of air flow.

Utility Sets are built of the finest materials by experienced craftsmen and are carefully tested and rated. They are available as standard packaged units all ready for you to install.

Ask the nearest American Blower Branch Office for full data.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of American Radiator & Standard Sanitary Corporation

YOUR BEST BUY AMERICAN BLOWER AIR HANDLING EQUIPMENT

Serving home and industry

AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILERS • ROSS HEATER • TONAWANDA IRON

26 MILLION TONS of steel scrap "ain't hay"

IT took 57,000 tons of steel to build the Empire State Building in New York. That's about one-tenth of one percent of the tonnage of scrap required to produce the new steel demanded for America's defense and civilian needs this year.

Half of this scrap is produced by the steel mills themselves. The other half - approximately 26 million tons - must be supplied by the public. That tremendous tonnage is the equivalent of 461 Empire State Buildings - over 1400 carloads of scrap every day of the year.

Right now there is a scrap shortage. It threatens to interfere with steel production. So we appeal to you, as a user of steel and steel products, to do all you can personally to help collect scrap.

Somewhere in your place of business - and even at home - there are things that can be scrapped - worn-out or obsolete machines, pipe, boilers, tools, structural parts, etc., that you'll never use again in their present form. Turn them in through regular channels. Call the nearest dealer and start your scrap on its way to the steel mills - to help America reach its production goal of 105 million tons of new steel in 1951. It is this team-work that will help us win the victory again.

YOUR SCRAP IS NEEDED — YOUNGSTOWN

The Youngstown Sheet and Tube Company

General Offices—Youngstown 1, Ohio

Export Offices--500 Fifth Avenue, New York

MANUFACTURERS OF CARBON ALLOY AND YOLOY STEELS

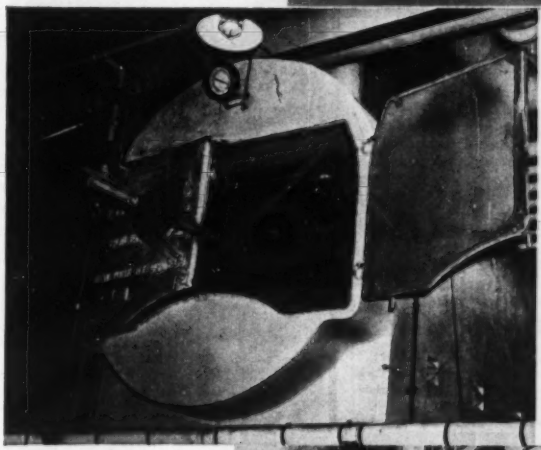
The steel industry is using all its resources to produce more steel, but it needs your help and needs it now. Turn in your scrap, through your regular sources, at the earliest possible moment.

SAVE LABOR
•
SAVE FUEL
•
INCREASE BOILER CAPACITY

DIAMOND

AUTOMATIC

"AIR PUFF" SOOT BLOWERS for Heating Boilers

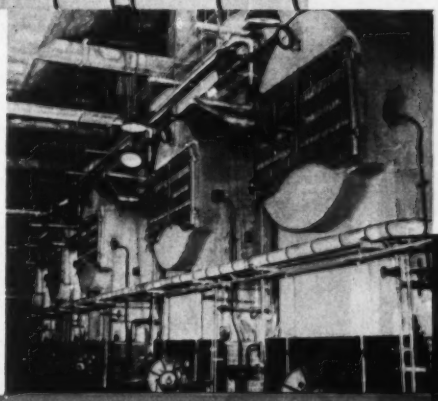


Accumulated soot in a boiler is a tremendous waster of fuel. Soot is an exceptional insulator . . . a very effective barrier to the heat. Cold rooms, higher fuel bills, general unsatisfactory operation are the result. Hand cleaning is inefficient, dirty, even dangerous.

Diamond A1E Automatic "Air Puff" Soot Blowers do a really efficient job of cleaning, without trouble, dirt, or nuisance. The boiler does not need to be taken off the line. The operator merely pushes a button and turns a valve . . . operation is automatic.

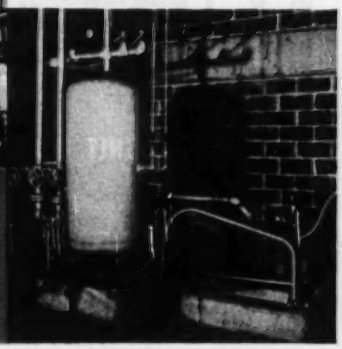
The Diamond "Air Puff" system is practically foolproof and is applicable to any number of boilers. For better heating, fuel saving, and a cleaner boiler room, investigate Diamond A1E Automatic "Air Puff" Soot Blowers. Write for Bulletin 897N.

▲ *Multi-Nozzle Element of A1E blower automatically rotates in a series of steps, blowing the entire tube bank. Cleaning is efficient—complete*



◀ *Five fire tube heating boilers at large housing project are cleaned with Diamond Automatic "Air Puff" Soot Blowers.*

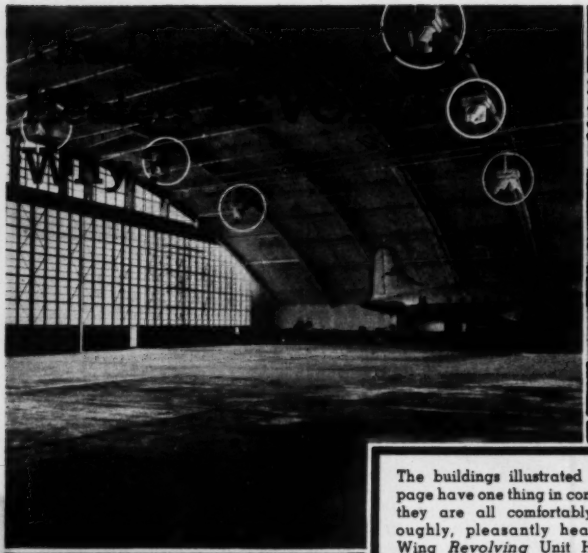
▼ *Small compressor and receiver supply all compressed air needed for battery of boilers shown at left.*

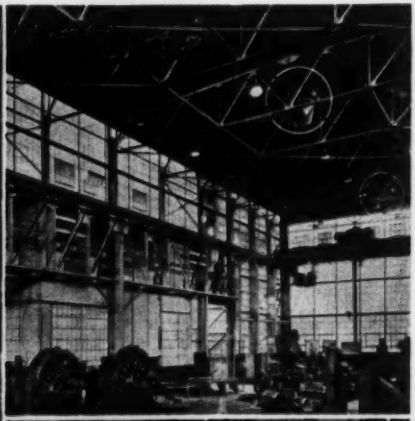


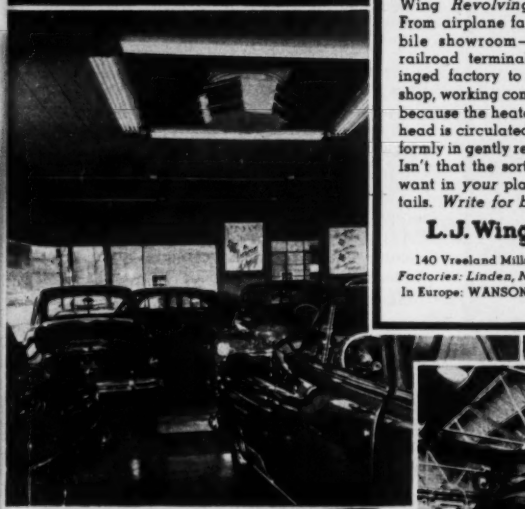
DIAMOND POWER SPECIALTY CORP.

LANCASTER, OHIO

Diamond Specialty Limited • *Windsor, Ontario*







The buildings illustrated on this page have one thing in common—they are all comfortably, thoroughly, pleasantly heated by Wing *Revolving* Unit Heaters. From airplane factory to automobile showroom—from gigantic railroad terminal and high-ceilinged factory to railroad repair shop, working conditions are ideal because the heated air from overhead is circulated slowly and uniformly in gently revolving streams. Isn't that the sort of heating you want in *your* plant? Get the details. *Write for bulletin.*

L. J. Wing Mfg. Co.

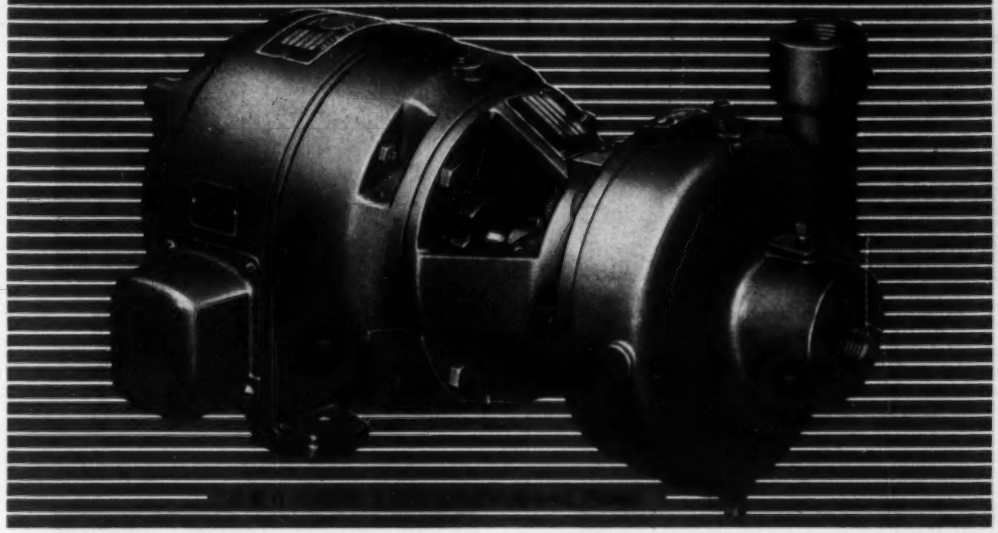
140 Vreeland Mills Rd., Linden, N.J.
Factories: Linden, N.J., Montreal, Can.
In Europe: WANSON, Brussels, Belgium

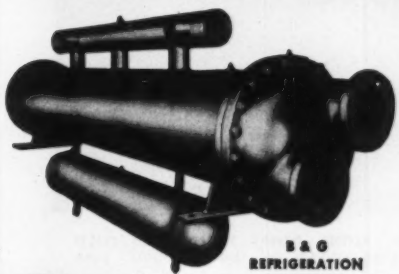
Wing

REVOLVING UNIT HEATERS

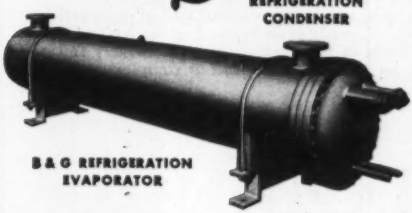
You can tell the Difference

...THE MOMENT YOU LAY EYES ON THE B&G 1522 PUMP





B & G REFRIGERATION CONDENSER



B & G REFRIGERATION EVAPORATOR

B & G *precision-built* Refrigeration Equipment offers new and better design—rugged construction — painstaking workmanship —all combined to provide top performance with longer service life. The many plus features added to the basic soundness of B & G design are a warranty of that priceless asset—*customer satisfaction!*

Write today for catalogs on B & G Refrigeration Equipment and B & G Centrifugal Pumps.

MADE TO ORDER FOR REFRIGERATION AND AIR CONDITIONING INSTALLATIONS

Measure the B&G Series 1522 Pump by any standards you choose . . . you'll say you've never before seen so many warranties of performance in a single unit.

The B&G Leak-proof Seal alone establishes this pump as the "buy" for your cooling tower or evaporative condenser installations. The Seal is self-lubricating and eliminates the usual leakage through the packing gland—assures long, trouble-free service.

It's a *quiet* pump. Long bronze sleeve bearings hold the shaft in alignment and the spring-type flexible coupling helps keep noise at a minimum. The impeller is *hydraulically balanced* . . . highly efficient.

Bearing bracket sub-assembly, including shaft and sleeve bearings, is interchangeable in all B&G 1522 Pumps. Easily serviced—the pump separates into three parts.

The B&G 1522 is available in all-iron, bronze-fitted, all-bronze or stainless steel units.

Send for Catalog CY-350

B & G

Hydro-Flo

REFRIGERATION EQUIPMENT

BELL & GOSSETT COMPANY

Dept. RCG-5, Morton Grove, Illinois

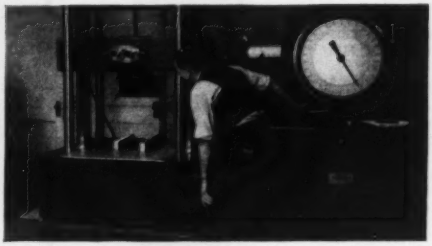
Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Road, Toronto, Canada

®Reg. U. S. Pat. Off

Why Grinnell is America's #1 Supplier of PIPE HANGERS *and* SUPPORTS

GRINNELL, ALONE, MANUFACTURES A FULL AND COMPLETE LINE OF HANGERS AND SUPPORTS

No other company, anywhere, makes a line as complete or varied. Grinnell produces hangers in thousands of combinations to support any piping.

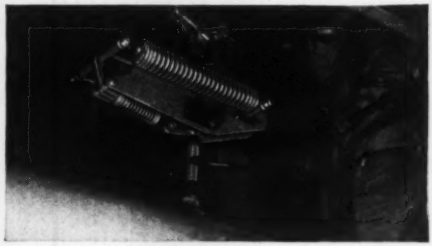


GRINNELL, ALONE, MAINTAINS AN EXPERIENCED LABORATORY STAFF OF TRAINED TECHNICIANS

In its modern, well-equipped laboratory, tests are constantly being made to discover better ways of solving old and new pipe suspension problems.

GRINNELL PROVIDES HIGHLY SKILLED ASSISTANCE AND ADVICE RIGHT FROM THE DESIGN STAGE

Grinnell's Pipe Suspension Department makes available specialized knowledge in the computation of hanger loads and the selection of the correct supports. No other company can match this service.



GRINNELL, ALONE, OFFERS EXPERIENCED FIELD ENGINEERING SERVICE ON THOSE "TOUGH" JOBS

Grinnell maintains an experienced staff of engineers in the field . . . ready to assist you "on the job" with any problems in the erection of pipe hangers and supports, no matter how difficult or complex.

WRITE FOR THIS FREE PIPE HANGER MANUAL

Here, between the covers of a single book, is everything you need to write hanger specifications. This book can be used both as a Grinnell Pipe Hanger Catalog and a comprehensive manual. It's available to you without cost . . . yours for the asking.

Pipe suspension presents a tremendously wide range of problems involving weight, stress, thermal movement, materials and specialized engineering. No one "goes into" the pipe hanger business overnight. Large manufacturing facilities, skilled technicians, and a lot of down-to-earth practical experience are needed.

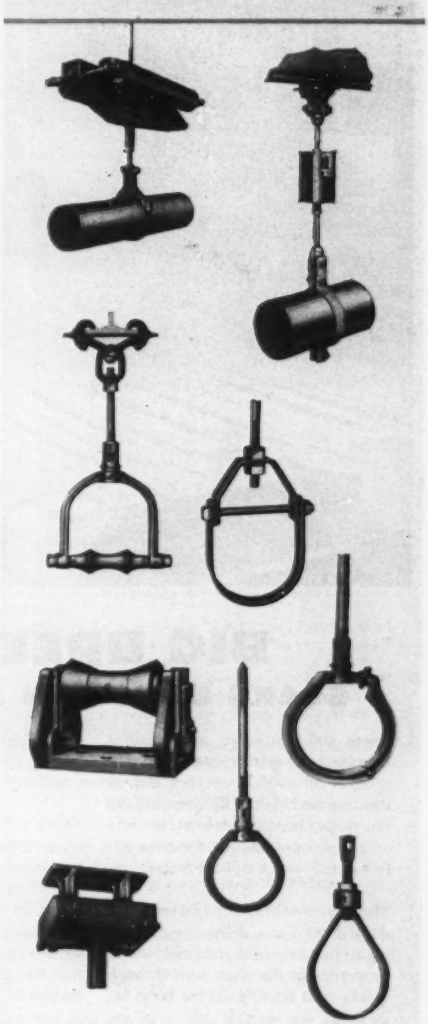
Grinnell has become America's No. 1 supplier of pipe hangers and supports only because Grinnell has specialized in piping for one hundred years. Grinnell has developed a line of pipe hangers and supports for every piping requirement, from the simplest to the most complex. Grinnell, and Grinnell alone, can offer these advantages:—

- Complete "start-to-finish" production facilities — including research, design, manufacture, engineering and field service.
- Practical experience in every type of piping gained during the past 100 years.
- Coast to coast distribution — enabling "out of stock" purchases, anywhere.

It is important to remember that should some detail of piping arrangement make it necessary to deviate from hangers of standard design, Grinnell will design and manufacture hangers to meet the special requirements. Also, Grinnell is always ready to co-operate with engineers and architects in the preparation of pipe suspension specifications.

Call Grinnell for pipe hangers and supports.

Grinnell makes pipe hangers and supports for every installation . . . from a simple water pipe to high pressure, high temperature steam lines. All are scientifically designed, ruggedly built.



GRINNELL, ALONE, THROUGH ITS CONVENIENT WAREHOUSES CAN SUPPLY YOU "OUT OF STOCK"

No manufacturer of pipe hangers offers a distribution system as thorough or efficient. Grinnell warehouses are located in 30 principal cities . . . with jobbers in practically every city, coast to coast.

GRINNELL

WHENEVER PIPING IS INVOLVED

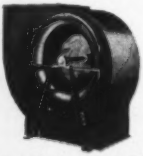
Grinnell Company Inc., Providence, Rhode Island • Sales Offices and Warehouses in Principal Cities

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco humidification and cooling systems

PUTTING *Air* TO WORK FOR ALCOA

Axiflo® Fans develop ample pressure to perform efficiently in duct systems and discharge against strong winds.

In **Elbow Axiflo Fans**, motors, belts and bearings are located outside the air stream, an advantage in handling corrosive fumes.



Silentvane® Centrifugal General Purpose Fans move air efficiently and quietly for many industrial and commercial applications.

BIG BREEZE

SOAKS UP 300° IN A HURRY

These 100-foot strips of structural aluminum are getting an air bath that sponges off 300° F. . . . but fast. A concentrated blast of air quenches the hot shapes leaving the forming mold . . . cools continuously for over 100 feet as they move down the line.

Mounted overhead are 17 Sturtevant Axial Flow Fans, delivering quenching air that helps maintain mechanical properties in the aluminum through quick, even cooling. These large capacity fans supply a steady stream of cooling air at high efficiency. Result: a uniform product for ALCOA.

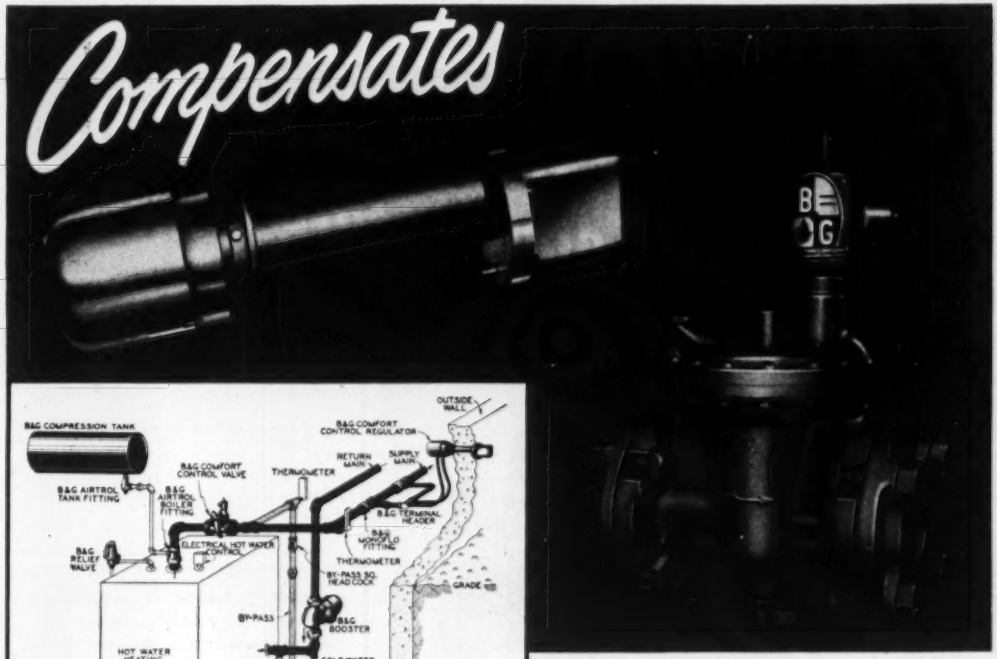
There's Westinghouse equipment ready to help you *put air to work* too . . . whether it's with air handling, air conditioning, or electronic air cleaning. Call your local Westinghouse-Sturtevant office for full details, or write Westinghouse Electric Corporation, Sturtevant Division, Hyde Park, Boston 36, Massachusetts.

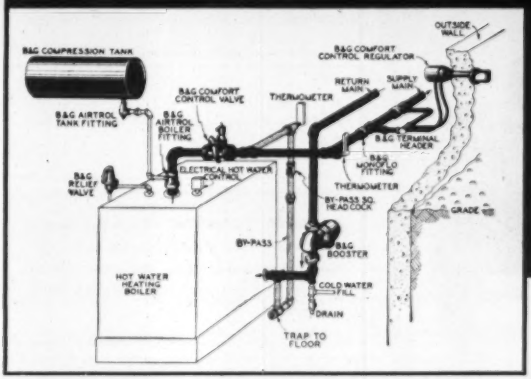
YOU CAN BE SURE...IF IT'S

Westinghouse

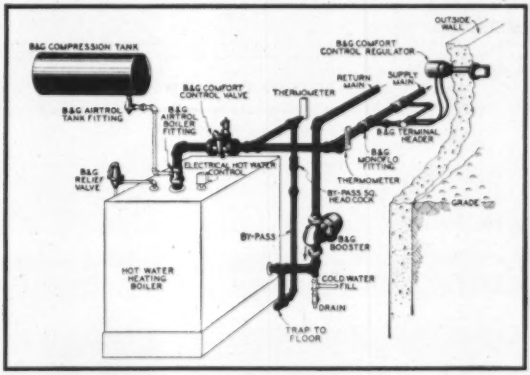
J-80226

Compensates





Here the Comfort Control Regulator is calling for heat and has caused the Comfort Control Valve to open, admitting hot water from the boiler to the heating system.



With the heat demand satisfied, the Comfort Control Regulator has closed the Comfort Control Valve so that water from the radiation circuits circulates through the by-pass instead of the boiler.

AN IMPROVED CONTROL FOR FORCED HOT WATER HEATING SYSTEMS

... automatically adjusts the heating rate for different wind velocities as well as outdoor temperature changes

Wind conditions definitely change the heat requirements of a building. To maintain a uniform indoor temperature, it is necessary to vary the heat supply in accordance with wind velocity, even with a constant outdoor temperature.

An exclusive feature of the B & G Comfort Control System is the unique arrangement whereby a small amount of heat is conducted from the heating circuit to the outdoors. *This is the feature which makes the Regulator truly wind compensating!* A strong wind dissipates the heat faster, requiring a higher system temperature to satisfy the Regulator.

The Comfort Control Regulator governs operation of the Comfort Control Valve. This Valve controls the flow of hot boiler water into the system and is opened or closed in accordance with the need for heat.

Only one adjustment to make

Simplicity of adjustment is an outstanding feature of the B & G Comfort Control System. Turning a single dial synchronizes the heating system with the building.

Send for descriptive literature

The complete story of this revolutionary control is available to you upon request. Write today.

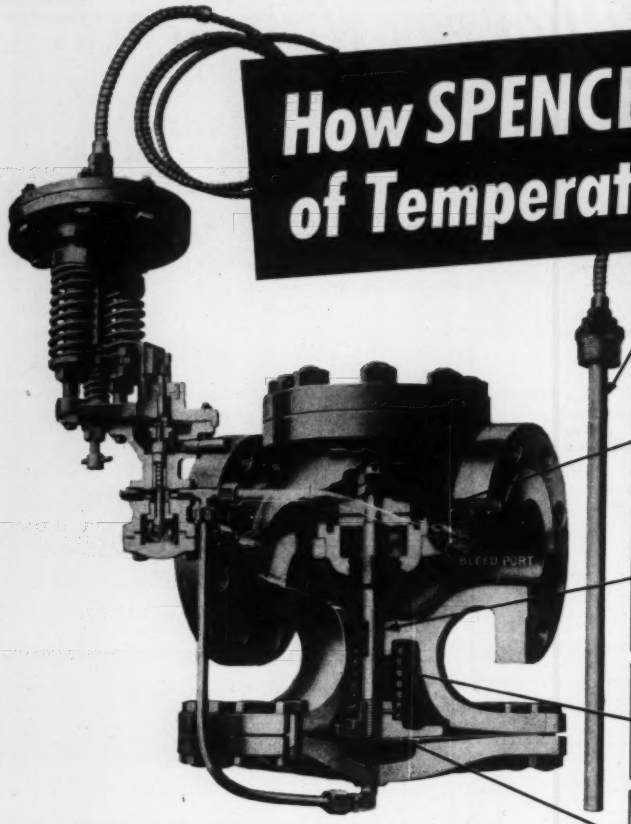
COMFORT CONTROL SYSTEM

BELL & GOSSETT COMPANY

Dept. CG-5, Morton Grove, Illinois

Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, Toronto, Canada

How SPENCE Cuts Costs of Temperature Control



NEW THERMOSTAT ELEMENT—Improved to practically eliminate loss of filling. Rugged construction; cannot be injured by overheating.

SECO METAL—Seats and discs are made of SECO Metal—guaranteed not to wire-draw.

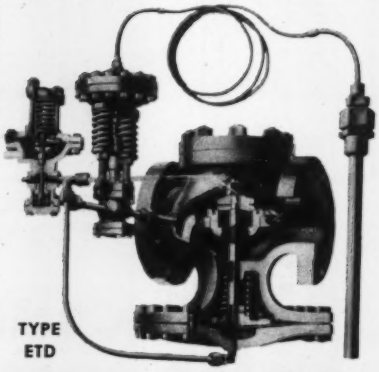
PACKLESS CONSTRUCTION — All Spence main valves and most pilots are built without stuffing boxes. This minimizes friction . . . eliminates much time-consuming maintenance.

PROTECTED SPRINGS — Springs in the Spence Regulator are out of the path of the steam or other fluid flowing through the valve.

LARGE BALANCED DIAPHRAGM— Spence metal diaphragms, under usual conditions, never require replacement.

Accurate Control for Both Storage and Instantaneous Heaters

Spence Temperature Regulators reduce the steam pressure and also accurately modulate the flow as required to control the temperature. No separate reducing valve is necessary • The Spence ET150 Regulator is recommended for heater pressures up to 50 psi. For higher pressures the Type ETD is available • For complete details on the entire Spence line of automatic regulating valves, strainers and desuperheaters, write for Bulletin 1200.



TYPE ETD

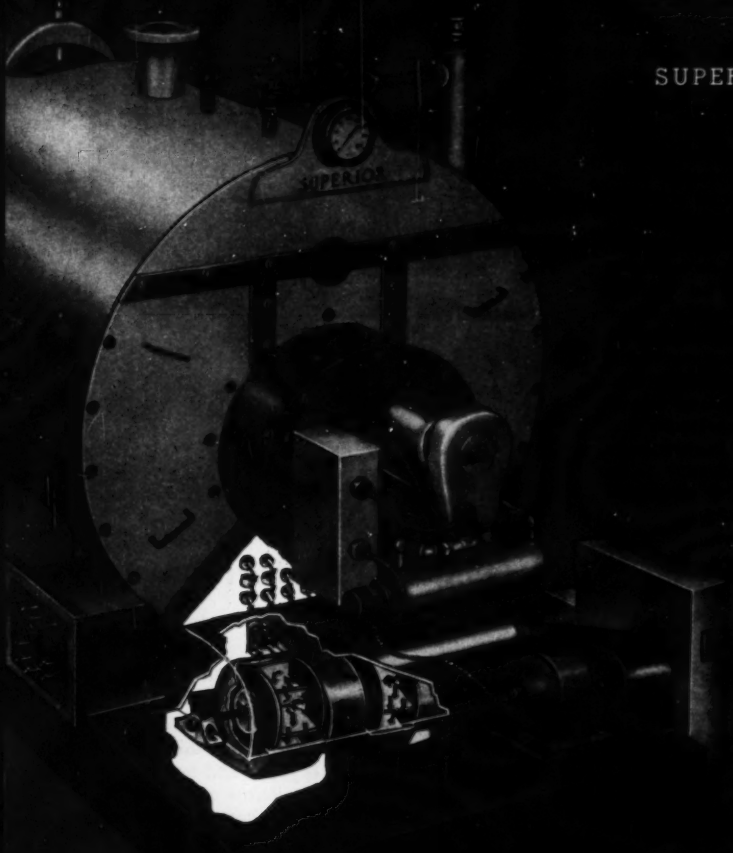
SR 111

Spence

SPENCE ENGINEERING COMPANY, INC.
WALDEN, NEW YORK

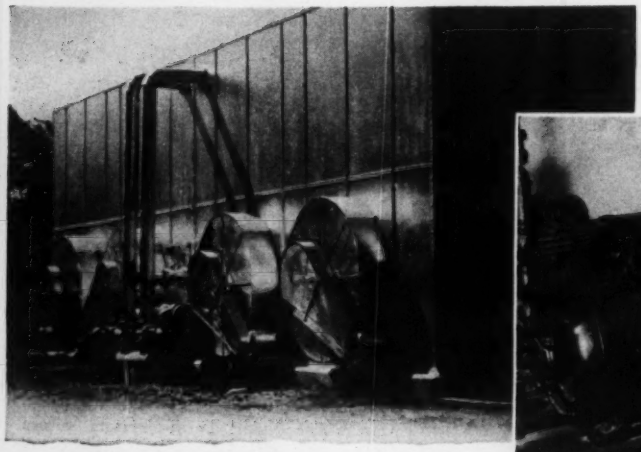
BETTER *because it's* BUILT-IN

SUPERIOR'S INDUCED DRAFT

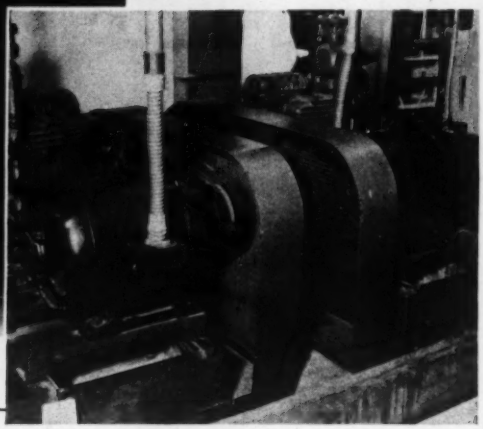


STEAM GENERATORS

uperior ombustion ndustries, inc.



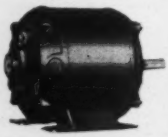
Four Century 5 horsepower splash proof motors driving fans.



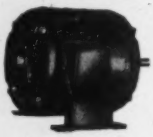
Two Century 30 horsepower motors driving refrigeration compressors.

Century

TYPE SC-
SQUIRREL CAGE MOTORS

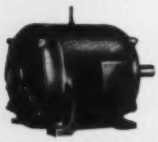


⅛ to ¾ horsepower



1 to 1½ horsepower

2 to 15 horsepower



20 to 125 horsepower

150 to 400 horsepower

Equipment Producers

Select Century Motors

To Give You Long-Life Performance With Least Down-Time

The correct selection of the right combination of motor type, speed, power, torque, frame and mounting keeps Century motors on the job.

Team work between your motorized equipment producers and Century motor engineers means that you always get the right motor—selected from Century's wide range of types and kinds, in sizes from ⅛ to 400 horsepower for single or polyphase alternating current and direct current. You can be confident that you get top performance from the fine equipment these motors drive.

Skillful application makes sure that Century motors meet the exacting requirements of the machines they drive. That's your assurance of dependability.

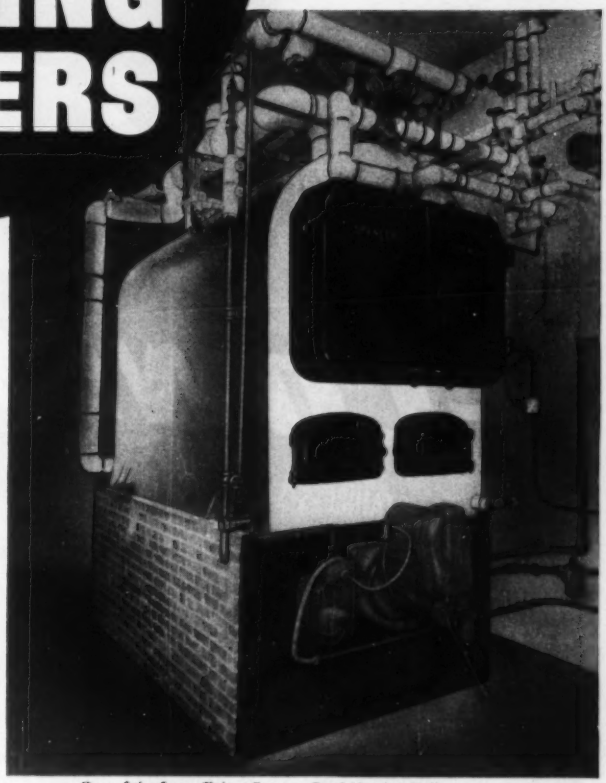
CENTURY ELECTRIC CO. 1806 Pine St., St. Louis 3, Mo.
Offices and Stock Points in Principal Cities

Century Electric Company is celebrating its 50th year in the electrical industry.

CE-650R

Specify Century C MOTORS for all your electric power requirements

SPENCER
The Quality line of HEATING BOILERS



One of the four efficient Spencer Steel Heating Boilers which supply the fifteen buildings of the modern River Edge Apartments, River Edge, New Jersey.

● ***There is a Spencer for every building, for every fuel.***

Both cast iron and steel . . . a selection of 76 models . . . versatile, dependable, backed by more than sixty years of leadership . . . precision-engineered and manufactured to give superior, *guaranteed* service.

Write for Spencer Catalogue *today.*

SPENCER
HEATER
LYCOMING-SPENCER DIVISION
WILLIAMSPORT PENNSYLVANIA

SMOOTH SURFACE
Assures Free Flow

FLOWLINE
TRADE MARK

STAINLESS STEEL, MONEL, NICKEL and INCONEL WELDING FITTINGS

Features of *FLOWLINE* Ells

For Dependable Corrosion Service

Free flow is a fundamental requirement of a piping system for corrosion service. The use of FLOWLINE fittings provides a smooth interior surface — without scratches, ridges, pockets, or sharp corners.

All FLOWLINE fittings — of which the 90° ell shown above is typical — include unique features that have been developed through our long specialization in the design and production of welding fittings for corrosion service.

The Welding Fittings organization was the first to standardize, manufacture, and stock a complete line of stainless welding fittings. Tees, ells, reducers, stub ends, and caps are available in sizes ½" through 12", in various pipe schedules.

WELDING FITTINGS CORP.
NEW CASTLE, PENNSYLVANIA
World's Largest Manufacturer of Stainless Welding Fittings

Personal Weather Control
AIR CONDITIONING SYSTEMS

Before you build... before you modernize

SEE HOW G. E. CAN HELP YOU CUT AIR CONDITIONING COSTS

The adaptability and equipment advantages of G-E Personal Weather Control Air Conditioning produce important savings in multi-room buildings of all kinds

Air conditioning that satisfies both building requirements and tenant desires...and yet is often substantially lower in cost than other systems—that's what you get with General Electric Personal Weather Control. Designed to supply year 'round comfort in office buildings, hospitals, hotels, apartment houses, and other multi-room structures, these newly-improved G-E Systems feature unparalleled flexibility.

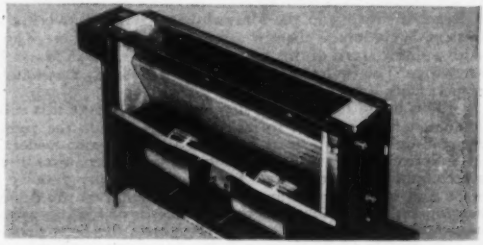
Building owners like the way G-E Systems can be quickly adapted to office rearrangement. Architects and engineers like the saving in space that is often possible because G-E Systems can be installed with small-size, high-pressure ducts or even without ducts. Tenants enjoy living and working in G. E.-air-conditioned buildings because they get individual room control of climate.

Here are a few of the ways you save!

LOWER INSTALLED COST! G-E Personal Weather Control Systems using the individual G-E Room Air Conditioner shown above often require substantially lower compressor capacity than competing systems. Application with small-size, space-saving ducts, or without ducts at all, can save both installation and building costs.

LOWER OPERATING COST! Since G-E Systems often require less compressor capacity, there's a saving in power cost too! Room units in unoccupied rooms can be shut off. When load conditions are reduced, units can be operated without running ventilation equipment. And G. E.'s filters help coils maintain top efficiency.

LOWER MAINTENANCE COST! All air—both room and ventilation—is filtered, protecting coils from dust and dirt which have been known to cut efficiency up to 15%. Simple, inexpensive filter replacement takes less than a minute. No costly coil cleaning.



LOWER REPLACEMENT COST! Attractive, rugged G-E Air Conditioners give top performance year after year. "Never had to replace one," says Clay J. Berry, The Fair Bldg., Fort Worth, where a 500-unit General Electric System was installed in 1939.

You can put your confidence in—

GENERAL ELECTRIC

General Electric Company, Air Conditioning Dept., Sec. HP-4, Bloomfield, New Jersey
Please send me, without obligation, detailed information on G-E Personal Weather Control Air Conditioning Systems.

NAME.....

COMPANY.....

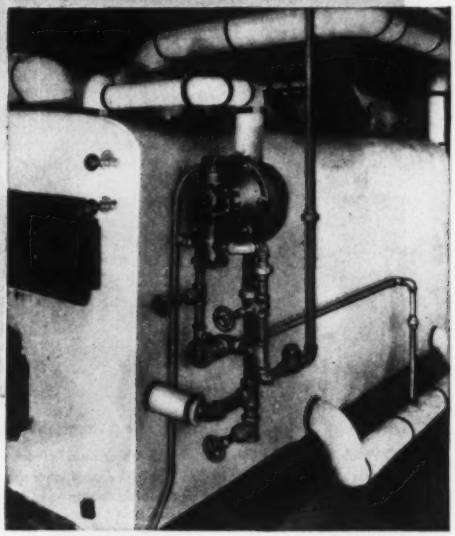
ADDRESS.....

CITY.....STATE.....

it doesn't take a law to keep a good man straight!

State of Massachusetts
Department of Public Safety
Rules for Low Pressure Heating Boilers
Section 5, Paragraph 93

AUTOMATIC WATER FEEDER: Where water of condensation of all of the steam generated by a boiler cannot be returned by gravity directly to the boiler, and pumps, traps or other devices are used for this purpose, or steam is used for purposes where there would be no water of condensation to return to the boiler, *an automatic water feeding device* shall be provided.



• Read this ruling in the Massachusetts Statutes covering automatic water feeders. We doubt if there is a heating man anywhere who would disagree with a single word of this ruling, and if it's right in Massachusetts, it's right anywhere. The boilers are the same in any State; low water trouble doesn't respect State lines.

This being the case, we suggest that you make this ruling your ruling. It doesn't require a law to make a smart man do the right thing, and the right thing for every steam boiler is a boiler water feeder.

Notice that the Massachusetts law, written after thoroughgoing research, points out the need for automatic *water feeding* where "pumps, traps and other devices are used." This confirms the opinion of foremost heating authorities that a mechanical means of feeding water is the first line of defense against low water. It recognizes the facts that a fuse can blow in a pump circuit, making a pump inoperative, or that return traps and other feeding devices, however dependable, can become temporarily inoperative. Under such conditions a boiler water feeder is the best safety device.

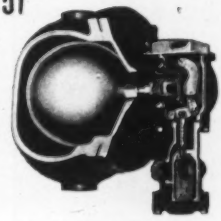
Rulings like this point up the need for boiler water level control on every boiler, but they cannot cover the most important fact of all—the fact that only the best water level control is good enough for the vital job of keeping the boiler water level where it belongs. In the opinion of a majority of heating men, McDonnell equipment alone is worthy of that trust.

Ask for latest condensed catalog covering all popular products

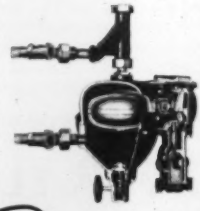
McDONNELL & MILLER, *Inc.*, 3500 N. Spaulding Ave., Chicago 18, Ill.

Doing One Thing Well

McDonnell No. 51



Boiler Water Feeder for boilers above 5000 sq. ft. capacity; maximum steam pressure, 35 lbs. For automatically fired boilers it is equipped with a low water fuel cut-off switch (No. 51-2).

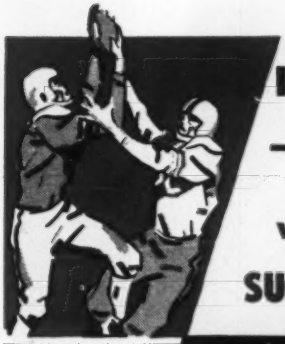


McDonnell No. 47

Boiler Water Feeder for smaller boilers (below 5000 sq. ft. capacity), maximum steam pressure, 25 lbs. Also available with low water cut-off for automatically fired boilers (No. 47-2).

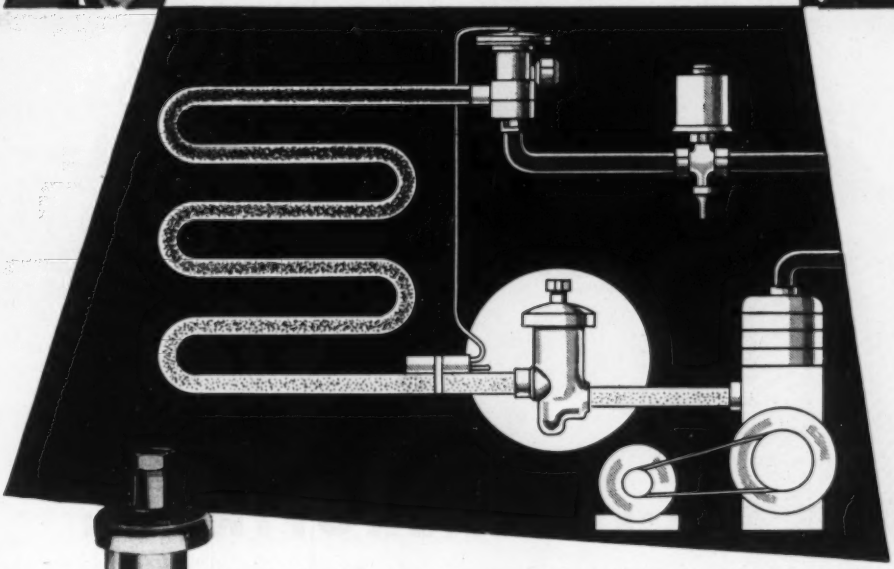
Your Jobber Stocks Them

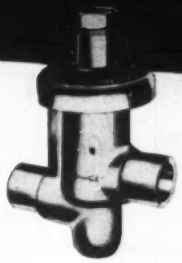
McDONNELL



INTERCEPT SUCTION PRESSURE —BLOCK OUT MOTOR TROUBLE!

with ALCO 771-772 SUCTION PRESSURE REGULATORS





Here's your strongest defense against burned-out motors. ALCO Suction Pressure Regulators give *engineered protection* against sudden motor overload caused by:

high starting loads
surges in suction pressure due to load change
high suction pressure caused by hot gas defrost
low voltage and high pressures

For star performance in any system, electric motor or gasoline driven, see 771-772 Suction Pressure Regulators at your ALCO wholesaler.

ALCO VALVE CO.

861 KINGSLAND AVE. • ST. LOUIS 5, MO.

Designers and Manufacturers of Thermostatic Expansion Valves; Evaporator Pressure Regulators; Solenoid Valves; Float Valves; Float Switches.

4862

ASK THE AEROFIN MAN

For the Practical Answer to Your Heat-Exchange Problem . . .

There is a competent Aerofin heat-transfer engineer near you, qualified by intensive training and long experience to find the *right* answer to your own particular heat-exchange problem.

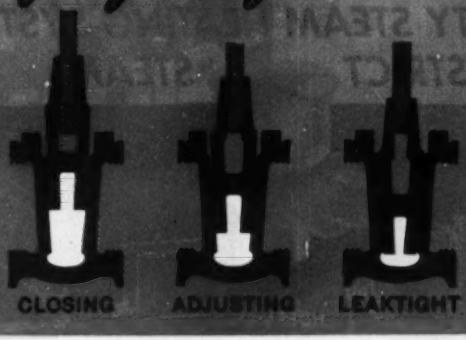
This specialized knowledge is there, ready for you to use to your greatest advantage. Ask the Aerofin man — and be right.

Aerofin is sold only by manufacturers of nationally advertised fan system apparatus. List on request.

AEROFIN CORPORATION

410 South Geddes St., Syracuse 1, N. Y.

Self-adjusting FLEXITITE DISC



Affords positive leaktight shut-off for all types of general service

You are one step ahead when you specify Ohio Brass gate valves. The Flexitite Disc® provides 100 per cent tight shut-off on all types of general service, yet you don't pay a premium price. Specially designed, the disc lifts clear to permit full unrestricted flow through the oversize valve port, and is absolutely leaktight in the closed position.

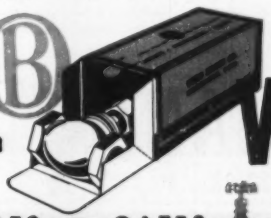
This unique disc is self-adjusting because only the outer disc edges have been sawed to permit a slight flexibility but solid wedge strength is retained by two connecting posts which join the disc faces. Closing the valve squeezes the wedge-shaped disc into the seat slot. The slight flexibility (exaggerated in diagram above) allows the disc to adjust itself to any minor irregularities, and to form an all-around metal-to-metal seal between seat and disc. A seal that remains leaktight even on hard-to-hold liquids like gasoline.

Your nearby Ohio Brass Company distributor carries a full line of Ohio Brass gate valves featuring the Flexitite Disc. He will be glad to discuss any of your plumbing and heating problems with you.

OHIO BRASS CO. MANSFIELD, OHIO

O-B No. 25 Line ¼ to 3-inch size. Also available with solder-type ends, ⅜ to 2-inch sizes. Both types can be furnished with conveniently placed drain plug.

4048-Y

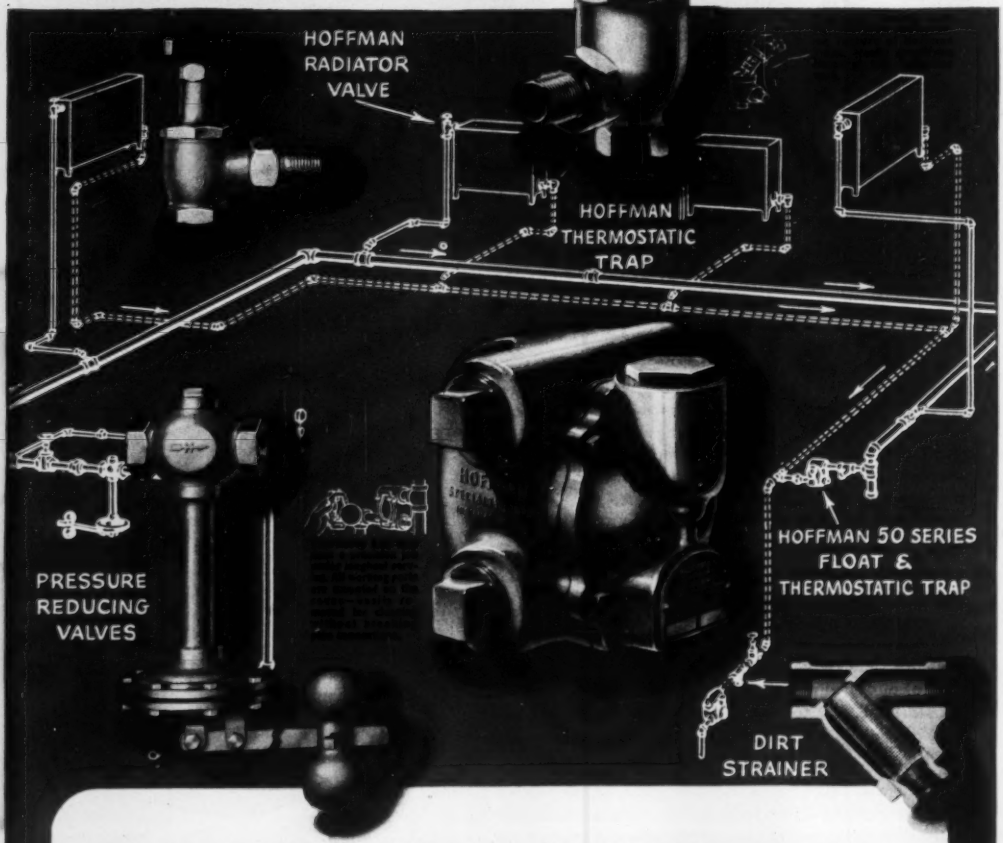


Ohio Brass VALVES

BRONZE GLOBES ANGLES GATES AND CHECKS

HOFFMAN STEAM SPECIALTIES

FOR TWO PIPE GRAVITY STEAM HEATING SYSTEMS SUPPLIED WITH DISTRICT STEAM



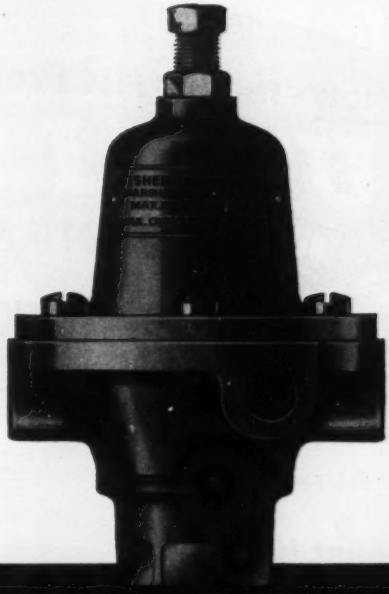
From Hoffman's complete line of Valves, Traps and Steam Specialties you can specify the correct unit for every specific requirement. And, *each* Hoffman product is distinguished by exclusive features that assure customer satisfaction, long, care-free service. *It's the* COMPLETE, *tested, quality line* backed by a dependable, single source of supply and responsibility. *Yet Hoffman Products cost no more than the ordinary kind.* To avoid delays—order now from your wholesaler of heating and plumbing supplies. Ask for new Catalog No. 951, no obligation.

HOFFMAN STEAM SPECIALTIES

HOFFMAN SPECIALTY COMPANY, Dept. FG-11
VALVES, TRAPS, VACUUM AND CONDENSATION PUMPS, FORCED HOT WATER HEATING

1001 York St., Indianapolis 7, Ind.
SYSTEMS Sold by Leading Wholesalers of Heating and Plumbing Equipment

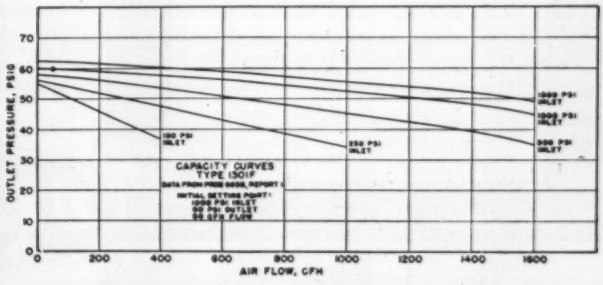
HIGH PRESSURE REDUCING VALVE for AIR or GAS SERVICE



Type 1301F is commonly used in conjunction with pilot operated controllers where high pressure operating medium is used. They are also used in general industrial applications for high pressure reduction of non-corrosive air or gas.

CONSTRUCTION:
All forged bronze construction with glass impregnated Teflon valve disc, stainless steel orifice. Furnished with one inlet connection and two outlet connections of ¼" pipe size.

PRESSURE RANGE:
Suitable for inlet pressures up to 3000 PSI; reduced pressure spring ranges of 10 to 75 PSI; 50 to 150 PSI. Adjustment screw for easy adjustment of reduced pressure setting.



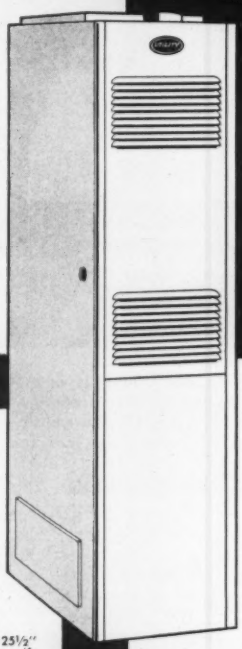
FISHER GOVERNOR COMPANY
Marshalltown, Iowa

UTILITY'S NEW 70FA

Dy-Rekt Drive Blower*

Sy-Lent Heat Exchanger*

*Registered



Sensational Low Price

Zero Clearance

UTILITY'S NEW "70FA" IS EASIEST TO SELL BECAUSE OF THESE FIVE REVOLUTIONARY NEW FEATURES:

1. New Dy-Rekt Drive Blower* is quietest yet—because of exclusive integrated, direct-drive assembly.
2. Newly-engineered Sy-Lent Heat Exchanger* practically eliminates noise as the furnace heats and cools.
3. Approved for Zero Clearance—can safely be installed flush with combustible material. No outside insulation needed.
4. Easiest to install—can be spotted in only 14"x25½" floor space—in closets, alcoves, etc. Completely self-contained.
5. The Utility Model "70FA" 70,000 BTU Forced Air Furnace is fully approved under latest AGA requirements.

Utility Appliance Corp., Dept. C-1151
4851 South Alameda St., Los Angeles 58, Calif.
Please send me FREE further information on the complete Utility line.

Name_____

Address_____

City_____ ( ) State_____

UTILITY now brings you a new high-performance furnace with unbelievable profit opportunities: The Utility "70FA"—a *full* 70,000 BTU forced air furnace at an amazingly low price we believe no other maker can match. The new Utility "70FA" 70,000 BTU Forced Air Furnace provides big-furnace luxury heating at a sensationally low price. It is also ideal for economical zone heating of larger homes. And it practically sells itself at its highly competitive price—so push the new Utility "70FA" and watch the profits roll in!

Your sales territory may be open—mail coupon today!

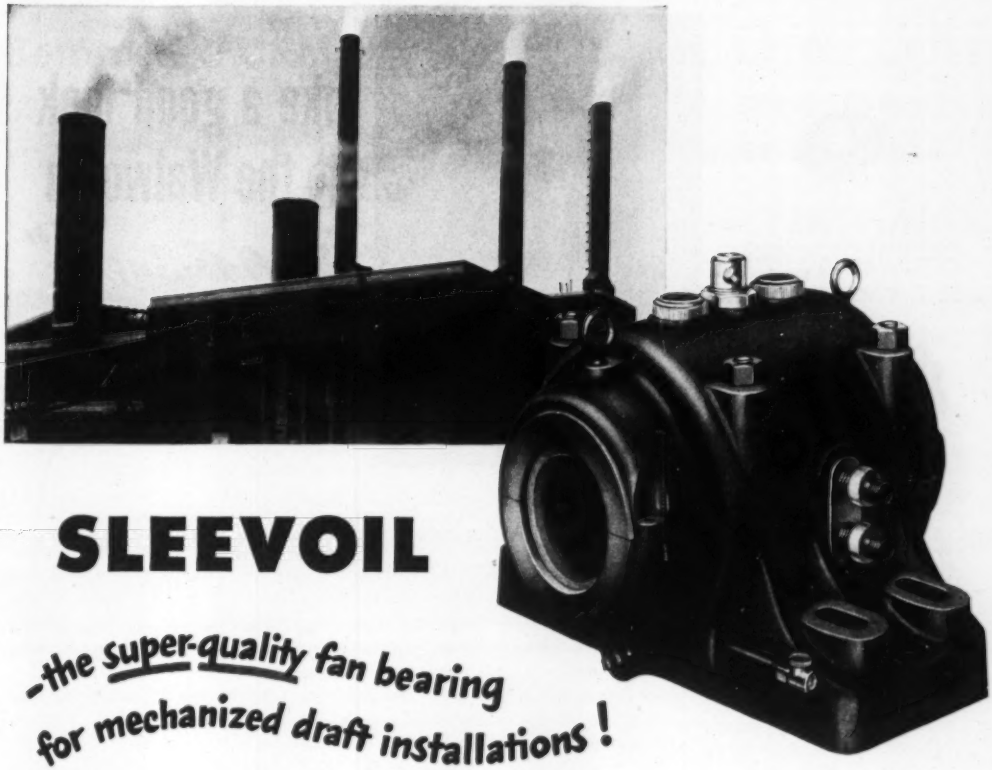
DELIVERIES NOW!

UTILITY TRADE MARK

guaranteed heating performance

UTILITY APPLIANCE CORP. 4851 South Alameda Street, Los Angeles 58, Calif.

MANUFACTURERS OF AIR COOLERS, GAFFERS & SATTLER AND OCCIDENTAL AUTOMATIC GAS RANGES



SLEEVOIL

-the super-quality fan bearing for mechanized draft installations!

● Hundreds of generating plants in America run on Dodge Sleevoil Bearings. These famous bearings combine quietness, long life and dependability to a degree unique in the bearing field. They offer engineers of costly power plants a priceless safeguard for their equipment.

Sleevoil Bearings are a Dodge development—created especially to meet the exacting requirements of fan and blower service. They are ideal bearings for important installations calling for induced or forced draft. Designed in cooperation with engineers of leading fan and blower manufacturers, they have a long record of dependable performance in critical service.

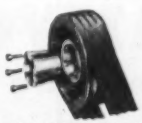
Dodge Sleevoil Pillow Blocks are normally available from stock—in both plain and water-cooled types, in shaft sizes from 1-7/16" to 8". Write us for information.

DODGE MANUFACTURING CORPORATION
1600 Union Street, Mishawaka, Indiana

DODGE
of Mishawaka, Ind.

CALL THE TRANSMISSIONEER, your local Dodge Distributor. Factory trained by Dodge, he can give you valuable assistance on *modern* power transmission machinery for *modern* installations. Look for his name under "Power Transmission Equipment" in your local classified phone book.

FIRST IN POWER TRANSMISSION MACHINERY!



V-BELTS AND TAPER-LOCK SHEAVES

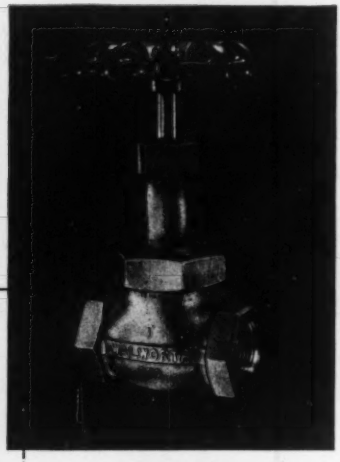
TORQUE-ARM SPEED REDUCERS

DODGE-TIMKEN PILLOW BLOCKS

ROLLING GRIP AND DIAMOND D CLUTCHES

FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY,
CHICAGO THRIFT-ETCHING CORPORATION, 1535 SHEFFIELD AVENUE, CHICAGO 22, ILLINOIS

IDENTIFICATION DISC: An aluminum marking plate on all Walworth No. 225P's facilitates inventory control and makes reordering quick and positive.



take a good look at the Walworth "500 Brinell" no. 225P Globe

NEWLY DESIGNED HANDWHEEL: Patented air-cooled, finger-fit handwheel affords sure grip even with greasy gloves.

– the Toughest Bronze Valve Your Money Can Buy

The stainless steel, corrosion resistant seats and discs are heat treated to a hardness of 500 Brinell – hard enough to scratch glass and crush nails! The valve can be closed on sand, slag, and pipe scale without injury to the seating surfaces. "Wire drawing" is practically eliminated. All parts are accurately machined and gaged. Years of tight, positive shut-off are assured.

Available in both globe and angle types (angle type: No. 227P) in sizes ¼" to 2", this quality valve is recommended for 350 lbs. W.S.P. at 550 F, and 1000 lbs. non-shock service on cold water, oil, gas, or air.

For full data on this long-life, economical Walworth Bronze Valve, see your local Walworth distributor, or write for Circular.

IMPROVED PACKING: Molded packing of lubricated asbestos reinforced with copper wire. Suitable for practically every service. Valves can be repacked under pressure when fully opened.

note these 7 Great Features

HEXAGONAL UNION BONNET CONNECTION, DEEP STUFFING BOX AND RUGGED STUFFING NUT: Union bonnet connection eliminates any chance of distortion or leakage even though valve is repeatedly taken apart and reassembled.

OVERSIZE STEM: The high-tensile strength silicon-bronze stem assures long life and protection against wear.

SEATS AND DISCS: Plug type seats and discs of stainless steel, heat-treated to 500 Brinell hardness and machined simultaneously to a mirror-like finish, with accurate tapers assures tight positive shut-off with minimum handwheel effort.

EXTRA STRONG BODY: Made of Composition M (ASTM B61) bronze. Thick walls and rugged hexes provide a high safety factor. Valves undergo hydrostatic shell test of 1,000 psi.

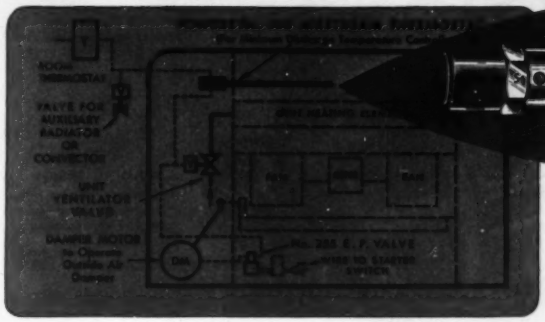
WALWORTH
valves and fittings
60 EAST 42nd STREET, NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

Better PERFORMANCE — Greater COMFORT

from the most accurate

UNIT VENTILATOR CONTROL *of them all*



POWERS

No. 356 LOW-LIMIT AIRSTREAM THERMOSTAT

A precision non-waste type instrument requiring no auxiliary devices to supplement its accurate low limit control of unit ventilator discharge temperatures.

POWERS Features that Give Better Control with Less Maintenance

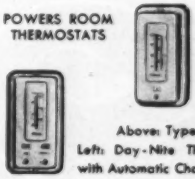
Since unit ventilators operate on minimum discharge temperature much of the time it is imperative that an accurate and dependable low limit thermostat be used.

- Powers 2-line non-waste Airstream Thermostats have a graduated dial for ease of adjustment—also Adjustable Sensitivity for precise control.
- With its ingenious non-waste double air valve mechanism there is no continuous waste of compressed air. It is not a "leakstat".
- Once set for the proper temperature a Powers No. 356 Thermostat requires no re-adjustment —there are no fine restrictions to be serviced.

Compare the performance of Powers unit ventilator control with others. You too will prefer its greater simplicity, accuracy and dependability. Benefits: More comfortable classrooms and less maintenance than with more complicated systems.

Write for Bulletin 301-AS

POWERS ROOM THERMOSTATS



Above: Type D.
Left: Day-Nite Thermostat with Automatic Changeover.

THE POWERS REGULATOR CO.

SKOKIE, ILLINOIS • Offices in Over 50 Cities

Chicago 13, Ill., 3819 N. Ashland Avenue • New York 17, N. Y., 231 East 46th Street
Los Angeles 5, Cal., 1808 West 3th Street • Toronto, Ontario, 195 Spadina Avenue
Mexico, D. F., Apartado 63 Bis. • Honolulu 3, Hawaii, P. O. 2755—459 Piikoi at Kona

(a08)

EVERY SEALMASTER BEARING

Pre-Lubricated

Cartridge unit

Flange unit

Flange-cartridge unit

Take-up unit

1. PERMANENTLY SEALED
Felt-lined steel flinger, rotating in labyrinth, excludes dirt and retains proper amount of lubricant.

2. SELF-ALIGNING
Bearing unit, with seals independent of housing, can align itself in any direction without seal distortion.

3. PRE-LUBRICATED
Before shipment from the SealMaster factory, the bearing chamber is filled with proper amount of lubricant.

4. NO HOUSING WEAR
Patented locking pin and dimple prevent rotation of outer race in housing. This eliminates housing wear, permits shaft alignment and positions unit for relubrication.

5. FLOATING RETAINER
Ball retainer is designed to float on ground inner surface of outer race. Traps lubricant, prevents churning.

6. HOUSING DESIGN
SealMaster's cast housings combine rigid, one-piece construction with smooth streamlined appearance.

Bearing maintenance at low cost is a feature worth designing into your machines. In SEALMASTERS the lubricant is sealed-in at the factory. Thus, SEALMASTER Ball Bearing Units assure smooth operation, and long life—with reduced power consumption.

Ask for Catalog 845—for complete data on SEALMASTER *Bearings.*

SEALMASTER BEARINGS
47 RIDGEWAY AVENUE, AURORA, ILLINOIS
A DIVISION OF STEPHENS-ADAMSON MFG. CO.

FACTORY REPRESENTATIVES AND DEALERS IN ALL PRINCIPAL CITIES

THERE ARE *5,750* SQ. INCHES OF HEATING SURFACE . . .

Young Type "F" Free-Standing Convector may also be installed in wall recess.

In This Popular-Size YOUNG Convector Core

Efficient heating is assured by the non-ferrous tube-and-fin heating element (illustrated)—developed by Young through a quarter-century of experience in engineering and manufacturing heat transfer products. Heating comfort is a certainty because of the quiet, steady flow of clean, draftless warmth circulated throughout the room by convection currents. Rounded cabinet corners and flanged edges, with styling that permits wall-recessing, produces a unit that is unobtrusive—one which blends harmoniously with any interior.

Versatility is yours, too. The Young Line offers a variety of cabinet styles (free-standing, wall-hung, recessed, low-level, etc.) for every rating—a type for every job. Your nearest Young Representative will gladly give you the details on special Young construction features that shorten installation time and provide complete customer satisfaction through years of use. Or, if you prefer, mail the coupon below for the Young Convector Catalog File.

YOUNG

Heat Transfer Products for Automotive and Industrial Applications.

Young Quality — Reg. U.S. Pat. Off.

Heating, Cooling, and Air Conditioning Products for Home and Industry.

YOUNG RADIATOR COMPANY
Dept. 511-L, RACINE, WISCONSIN

Factories at Racine, Wisconsin and Mattoon, Illinois
Sales and Engineering Representatives
in All Principal Cities

LEARN HOW YOUNG CONVECTOR-RADIATORS CAN CUT CORNERS ON HEATING BUDGETS

YOUNG RADIATOR COMPANY
Dept. 511-L
Racine, Wisconsin

Rush me full details about the Young Convector-Radiator Line, without obligation.

Name_____

Address_____

City_____ Zone____ State_____

NEW CONDENSATE RETURN UNIT...

Sensational!

"Wide application!!!"
"Single phase or 3-phase 1750 RPM motor"
"10 or 15 gal. cast iron receiver (available in steel, too!)"
"Handy where piping is close to floor level"
ROTH
"Small vertical unit"
"2 sizes cover range up to 8000 sq. ft. EDR at 20 psi"
"Submerged pump handles liquid at 210°F —without vapor lock"
"May be installed in shallow pit— needs minimum floor space!"

ALL THIS AT UNBELIEVABLY LOW PRICES!!!

How can Roth make such a high quality vertical condensate return unit at astonishingly low prices? Roth has geared its manufacturing facilities and experience in mass production of pumps to produce top quality units at a price you can't afford to miss. *Roth Pumps* are made to tolerance of one-thousandth of an inch. Only the finest quality materials are used. Stainless steel shaft, bronze impeller and side plates. Every pump is individually tested. Construction meets the most exacting requirements. Motors and switches are the finest. See your nearest distributor or write direct today. Ask for Bulletin No. 212.

ROTH PUMPS

ROY E. ROTH COMPANY
2420-K 4th AVE., ROCK ISLAND, ILL.

SALES AND SERVICE IN THESE PRINCIPAL CITIES OF U. S. AND CANADA:

AKRON, O.—B. W. Rogers Co., 850 S. High St., Hemlock 4181
ALBANY, N. Y.—Peck Pump & Equip. Co., 131 Hudson Ave., 5-4844
ALBUQUERQUE, N. M.—Sebree Equip. Co., 610 N. Second St.
ATLANTA, GA.—John L. Underwood Co., Inc., 555 Whitehall St., S. W., Main 7878
BOSTON, MASS.—Berg-DiMare & Berg, Inc. 87-93 Haverhill St., Lafayette 6172-3-4
CHARLESTON, W. VA.—Cross Pump and Equip., Box 889
CHICAGO, ILL.—Lowden and Co., 540 W. Lake St., Central 6-3958
CLEVELAND, O.—Barrington & Son Inc., 4821 Superior Ave., Express 7828
COLUMBUS 12, O.—C. K. Dye, 2656 Canterbury Rd., Kingswood 3052
DALLAS ,TEX.—Lone Star Pump & Mach., 5306 Harry Hines Blvd., Justin 8-1120
DENVER, COLO.—Harry J. Glass & Asso., P. O. Box 1085, Dexter 8151
DETROIT, MICH.—Heating Equip. Co., 14565 Glastonbury, Vermont 6-4689
INDIANAPOLIS, IND.—Jackson Eng'r'g Co., 934 Architect & Builders Bldg., Lincoln 3463
LAKE PLACID, N. Y.—Carl A. Bovard, 42 Hillcrest, 383
LOS ANGELES, CAL.—Frederick Pump & Eng. Co., 5743 Duarte St., Kimble 8189
LOUISVILLE, KY.—Allan K. Cook, 505 S. Third St., Jackson 2716
LUBBOCK, TEX.—S. H. Baldwin Co., 615 Lubbock National Bank Bldg., 2-5428
MILWAUKEE, WIS.—Dodge Pump Co., 446 N. 29th St., West 3-8433
MINNEAPOLIS 14, MINN.—Leon C. Gadbois, 2524 University Ave., S.E., Gladstone 2811
MONTREAL, CAN.—Air Cond. & Eng., Ltd., 636 St. Paul St. West
NEW YORK CITY, N.Y.—Frank A. Kristal, 30 Church St., Cortland 7-7652
OKLAHOMA CITY, OKLA.—Loeffler-Greene Sup. Co., 1604 N. W. 5th, 3-5315
OMAHA 2, NEB.—D. E. McCulley Co., 814 S. 14th St., Webster 6373
PHILADELPHIA, PA.—Walter H. Eagan Co., 2336 Fairmont Ave., Stevenson 7-2300
PITTSBURGH, PA.—Weinman Pump & Sup. Co., 317 S. Main St., Walnut 1-7704
PORTLAND, ORE.—Pump, Pipe & Power Co., 1624 S. E. Grand Ave., Vermont 4173
SALT LAKE CITY 8, UTAH—Nickerson Mach. Co., P. O. Box 216, 4-9784
SCRANTON, PA.—Frank A. Phillips, 328 Garfield Ave., 4-4933
SEATTLE, WASH.—Vinsor Co., 105 Orcas St., Radnier 0217
SOUTH BEND, IND.—Smith-Monroe Co., 912 S. Main St., 6-6343
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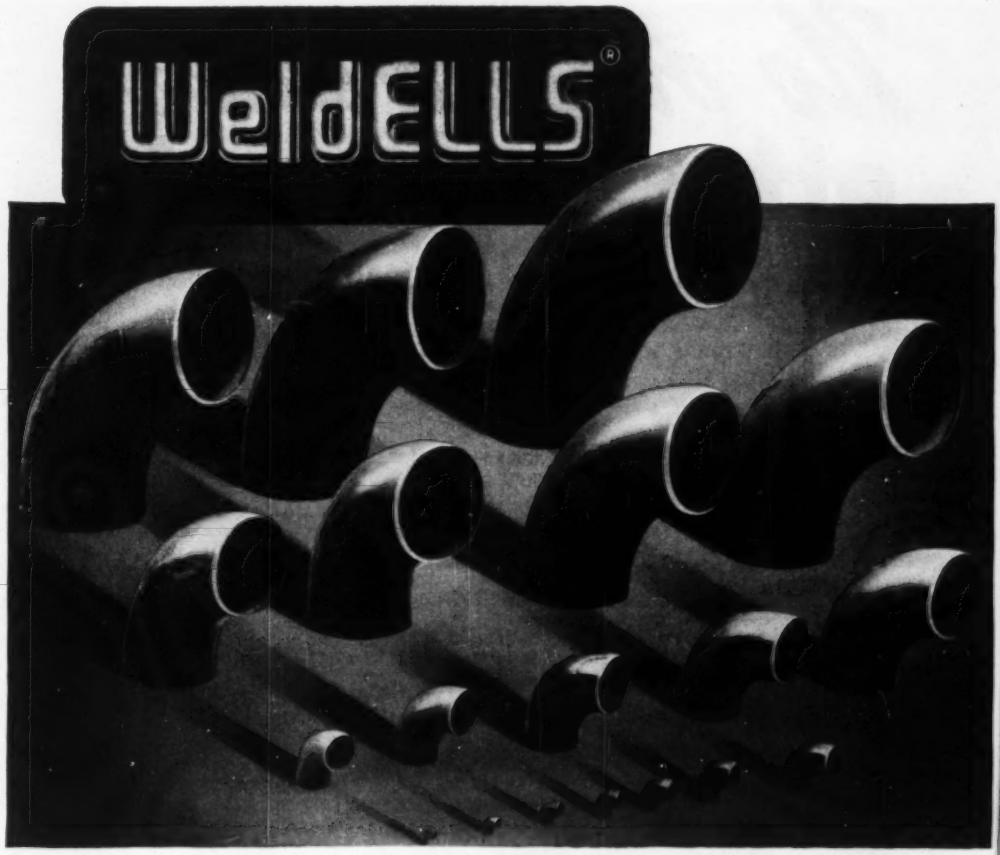
TORONTO, CAN.—Bawden Ind., Ltd., 163 Sterling Rd., Loidbrook 3188
UNION, N. J.—J. L. Cunningham, 370 Huntington Rd., Unionville 2-4046
WICHITA, KAN.—J. M. O'Connor, 208 N. Waco, 2-3484



Just a Corner of the World's Largest Line

Illustrated above are the stock sizes of long-radius WeldELLS in a single weight and material. Multiply this group by all the weights, all the types and all the materials, and you have the world's largest line of forged fittings for pipe welding.

The Taylor Forge line grew to this size because nothing less could meet the demand for fittings of Taylor Forge design, quality, accuracy, uniformity.

Make this your final reason for insisting on the WeldELL line for every fitting and flange requirement. Coupon brings new data sheet described below.

TAYLOR FORGE

TAYLOR FORGE & PIPE WORKS • General Offices and Works: P. O. Box 485, Chicago 90, Ill.
Offices in all principal cities • *Plants at: Carnegie, Pa.; Fontana, Calif.; Hamilton, Ont. Canada*

TF

A volume of data on a single sheet

Data on welding fittings and flanges condensed on two sides of a durable, varnished, letter-size card. Particularly useful for the pipe designer. Coupon brings your copy.

Send one of your fitting and flange sheets to:

NAME_____

POSITION_____

COMPANY_____

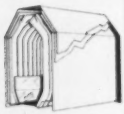
STREET ADDRESS_____

CITY_____ ZONE____ STATE_____

Mail to Taylor Forge & Pipe Works, P. O. Box 485, Chicago 90, Ill.

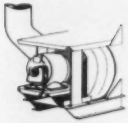
510-1151

No other Heater offers so much



MORE HEATING SURFACE FOR LONGER LIFE

Standard 10 gauge, 4" boiler tubes give more effective heat transfer surface.



SEPARATE DRAFT FAN

Eliminates cold blast at every start. Especially appreciated by employees.

EASY ACCESSIBILITY FOR LOW COST SERVICE

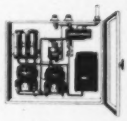
All accessories mounted outside. Can be serviced without dismantling.

ALL POPULAR PARTS —EASILY AVAILABLE ANYWHERE, ANYTIME

All standard products of nationally known manufacturers.

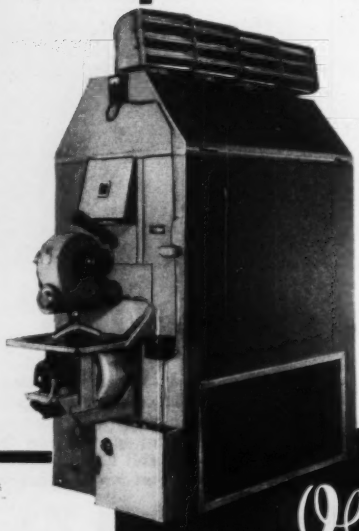
RIGID CONSTRUCTION FREE FROM VIBRATION

Low fan speed, heavy-duty shaft, large, self-aligning ball bearings.



DUST-TIGHT DAMP-PROOF CONTROL BOX

Within sight and reach of all burner adjustments. Control circuit 110 vlt.



THESE FEATURES PROVE THE SUPERIORITY OF AN OLSON

Olson

ARTHUR A. OLSON & CO.
Gas, Oil, Coal or Dual Gas and Oil
BROAD ST. · CANFIELD, OHIO

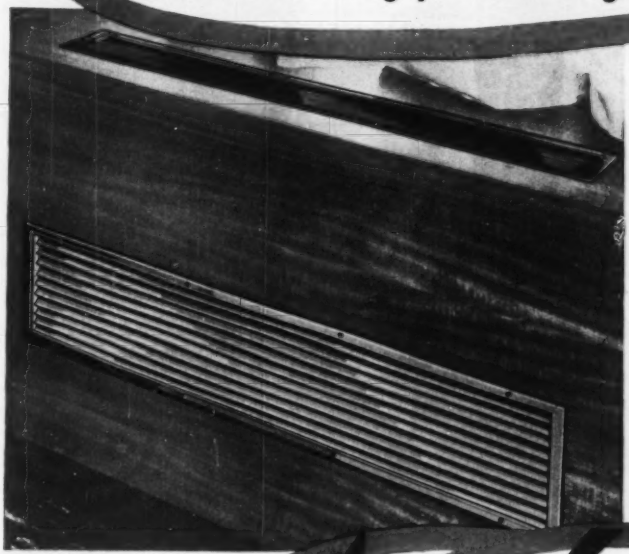
WRITE *for Bulletin and engineering data sheet showing horizontal and inverted models plus other installation data and information.*

LESS FUEL AND LESS MAINTENANCE WITH AN OLSON ON THE JOB

The high efficiency of the Olson design provides low fuel consumption. For example, the automatic thermostat controls keep the slow turning blower fans running until the last measure of heat has been dissipated — even after the combustion stops.
There's no worries about shut downs — most all of the Olson parts can be serviced from the outside while the heater is in operation — this means the savings of extra maintenance and costly delays in production. Why not investigate Olson Heaters for your next application or replacement?

INSTALL Custom Designed CONVECTOR GRILLES

without increasing your building costs



- **EXTRA RUGGED**
  Made to *withstand heaviest use and abuse* which lower wall grilles must take.
- **TAMPER PROOF**
  No "see-thru". Extra-close spacing of louvers prevents gum wrappers—waste paper from being dropped between louvers.
- **EXTRA-HEAVY SUPPORT BARS**
  Heavy-duty steel bars on 6" centers give added strength where it is most needed.
- **MADE TO ANY SIZE**
- **OVER 70% FREE AREA**
- **EASILY INSTALLED**
  Precision built to fit snugly. Can be installed in marble, tile or other special surfaces.
- **EXTRA-WIDE BLADES FOR MOST EFFICIENT DEFLECTION OF AIR**
- **EACH DEFLECTING BLADE "HEMMED" FOR ADDED STRENGTH —ADDED SAFETY**
- **ALSO AVAILABLE WITH DAMPER AND KNOB CONTROL**

Above
Photo shows AIRFOIL convector grilles installed in John Hancock Building.

Architects—
Crame & Ferguson, Boston, Mass.

Gen. Contractors—
Turner Const. Co., Boston, Mass.

Heating & Ventilating Engineers—
Buerkel & Co., Inc., Boston, Mass.

Sheet Metal Contractors—
Stanley E. Priggen Co., Boston, Mass.

AirFoil

AIR CONDITIONING OUTLETS

Free

AIRFOIL CUSTOMED CONVECTOR GRILLES are *built above and beyond average demand. Give air distribution performance that's above and beyond average—YET COST IS KEPT AT STANDARD PRICES.*

Superior construction and performance usually reserved for the highest-priced grilles are incorporated as standardized features of this great new line of convector grilles. *They meet the most exacting specifications of architects and engineers.*

AIRFOIL CONVECTOR GRILLES are better designed—more durable. Feature for feature, dollar for dollar—they cannot be duplicated. Made with a "decorator's touch," *they add new beauty to any installation.*

CHECK TYPE OF GRILLE ON WHICH INFORMATION IS DESIRED

- ☐ Air conditioning outlets
- ☐ Return air grilles and registers
- ☐ Volume controllers
- ☐ Perforated metal and ornamental grilles
- ☐ Door ventilators
- ☐ Special made-to-order grilles

TITUS MANUFACTURING CORP., WATERLOO, IOWA

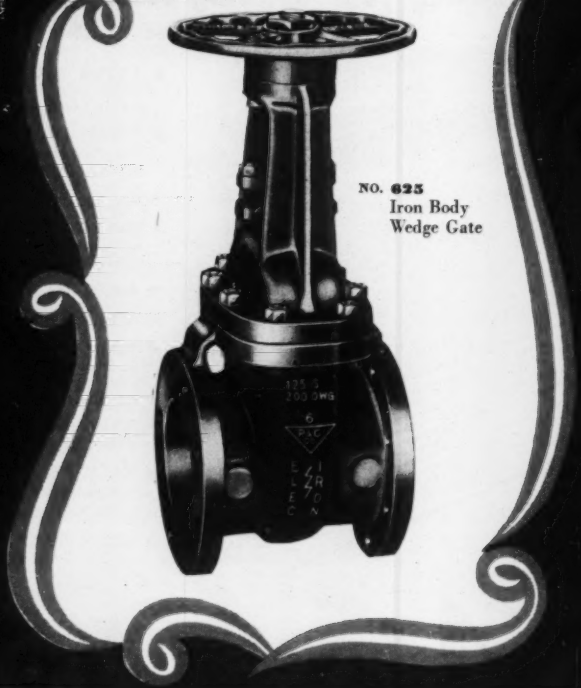
- ☐ RUSH information on Convector Grilles.
- ☐ Send complete catalog.
- ☐ Send literature on above checked items.

NAME_____

ADDRESS_____

CITY_____ STATE_____

R·P&C VALVES



NO. 625
Iron Body
Wedge Gate

You Pay No More For These Extra Values

In R-P&C's Iron Body Gate Valve you get . . .

Highest quality cast iron made by R-P&C's advanced electric furnace melting process. This fine-grained iron offers physical properties far exceeding specification minima.

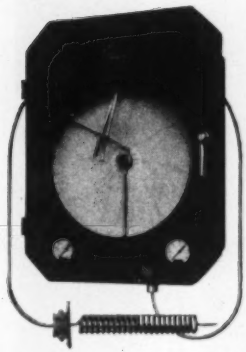
Reinforcing tie ribs between bonnet and end flanges. This gives added strength to valve body.

Yoke cap construction. This imparts ruggedness plus ease of repair.

Ask your local R-P&C distributor about this extra value Iron Body Gate Valve—or write the nearest R-P&C district office.

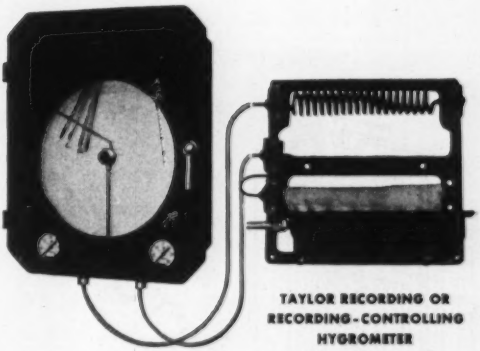
R-P & C VALVE DIVISION
AMERICAN CHAIN & CABLE

"Intentionally Better"
READING-PRATT & CADY VALVES



TAYLOR FULSCOPE* TEMPERATURE CONTROLLER

Regulates diaphragm valves and lever motors for operation of dampers, etc., to make your air conditioning system work smoothly. Automatically compensates for load changes. Controls refrigeration compressors. Gives you automatic seasonal changeover.



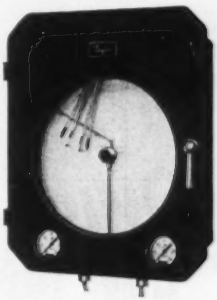
TAYLOR RECORDING OR RECORDING-CONTROLLING HYGROMETER

With continuous water feed. Ideal where air circulation is good, and panel is well located within apparatus, room or duct for best circulation across bulbs. Available with constant level or bottle-fed water reservoir.

What's *your* air conditioning control problem?

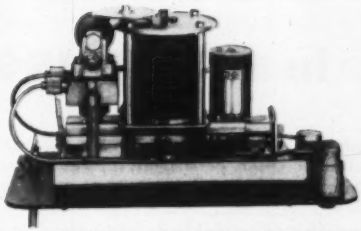
DO you need a single control instrument for an isolated application? Or complete controls for a complete air conditioning system?

Taylor makes a full line of accurate control instruments for every air conditioning need. We'll be glad to work with you or your consulting engineers or contractors to give you the instruments best suited to your individual problem. Ask your Taylor Field Engineer or write Taylor Instrument Companies, Rochester, N. Y., or Toronto, Canada.



TAYLOR FULSCOPE* RATIO RECORDING CONTROLLER

Ideal where you need control in one medium in a definite relationship to some other variable medium . . . such as inside temperature control in summer air conditioning according to variable outdoor temperatures.

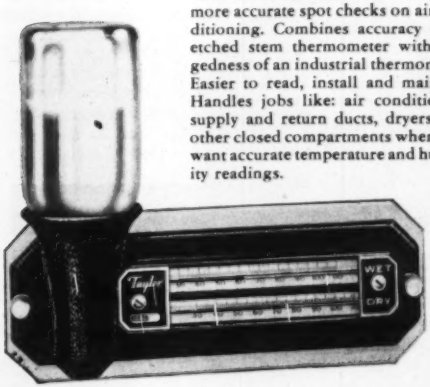


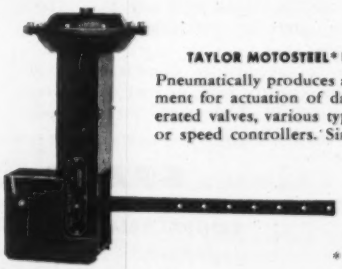
TAYLOR TRANSAIRE* TEMPERATURE TRANSMITTER

New force-balance pneumatic transmitter that meets all normal air conditioning requirements with Simple Operation, Positive Transmitting action and Rapid Response to Temperature Changes. Ideal where zones are remotely located from centralized control room.

TAYLOR 108G HYGROMETER

With bottle-fed reservoir. Perfect for more accurate spot checks on air conditioning. Combines accuracy of an etched stem thermometer with ruggedness of an industrial thermometer. Easier to read, install and maintain. Handles jobs like: air conditioning supply and return ducts, dryers, and other closed compartments where you want accurate temperature and humidity readings.

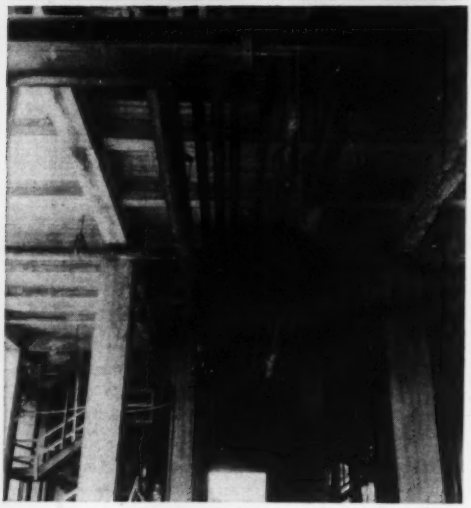




TAYLOR MOTOSTEEL* LEVER MOTOR

Pneumatically produces a thrusting movement for actuation of dampers, lever-operated valves, various types of governors or speed controllers. Simple, low-priced.

* Registered Trade-Mark



it's SPANG "CW" pipe

in PITTSBURGH'S GATEWAY CENTER

Floor upon floor the three skyscrapers in Pittsburgh's Gateway Center climb persistently upward. And, in each building, the installations of Spang "CW" Pipe follow the structural steel from bottom to top.

These modern office buildings, when finished, will be equipped from top to bottom with Spang "CW" Pipe—a complete system of piping for air conditioning, chilled water system, heating, sanitary facilities, etc.

The selection of Spang "CW" Pipe for this important construction project is further recognition of the controlled quality of Spang pipe mill products—widely known for durability and dependability for more than a century.

Wherever pipe is specified in commercial, residential or industrial construction, be sure to ask your jobber for Spang "CW". That trade mark is *your guarantee* of *customer satisfaction.*

Owners: *The Equitable Life Assurance Society of the United States, New York, New York*
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Air Conditioning & Heating—Kerby Saunders, Inc., New York, New York

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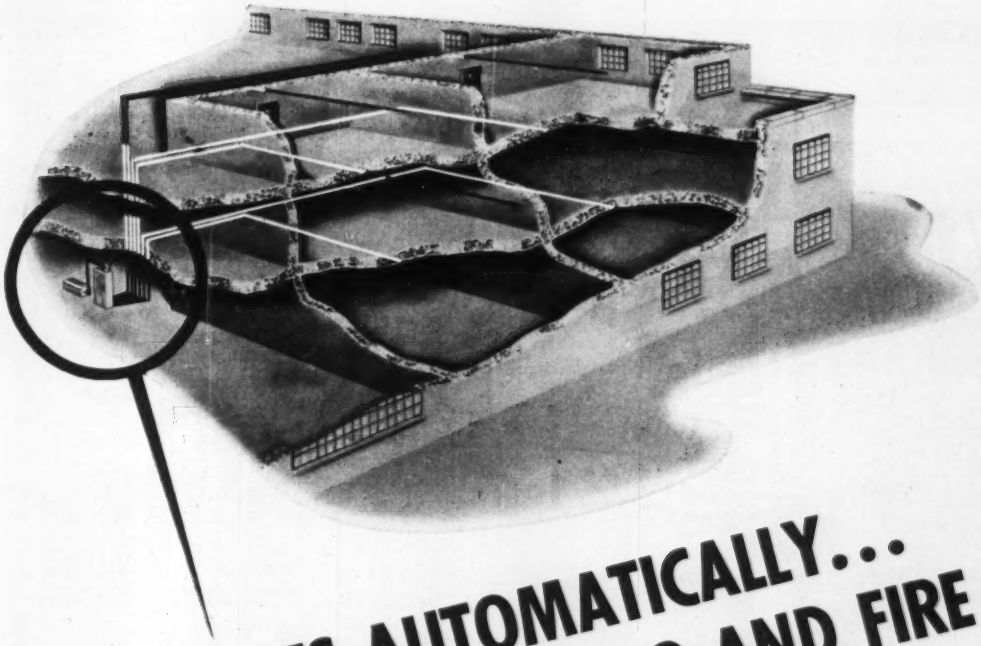

DETECTS AUTOMATICALLY... SMOKE, SMOLDERING AND FIRE

at any location in your plant or warehouse!

Each fire hazard point gets highly efficient, round-the-clock fire watchman service simultaneously, when a building is completely protected with a modern, fully approved C-O-TWO Automatic Smoke Detecting System.

The first whiff of smoke sets off an alarm, based on an exclusive operating principle . . . no chance of smoke, smoldering or fire spreading . . . instantly, the air conditioning shuts down, doors and dampers close, operating equipment stops and fire extinguishing systems actuate . . . a truly automatic fire watchman.

Four types of smoke detectors and several installation arrangements are available to fit your particular needs . . . single space systems, double space systems, multiple space systems, air conditioning duct systems . . . all function by drawing continuous air samples through simple piping to a smoke detector.

Actual fire tests made by the Underwriters' Laboratories, Inc. show that fire detection with this type of smoke detecting equipment is much quicker than other methods . . . because usually there is smoke or smoldering before flames break out.

Remember fire doesn't wait . . . so, with current expensive delayed replacements, why not let an expert C-O-TWO Fire Protection Engineer help you now in planning economical, fully approved fire protection facilities. Write today for complete free information . . . no obligation.

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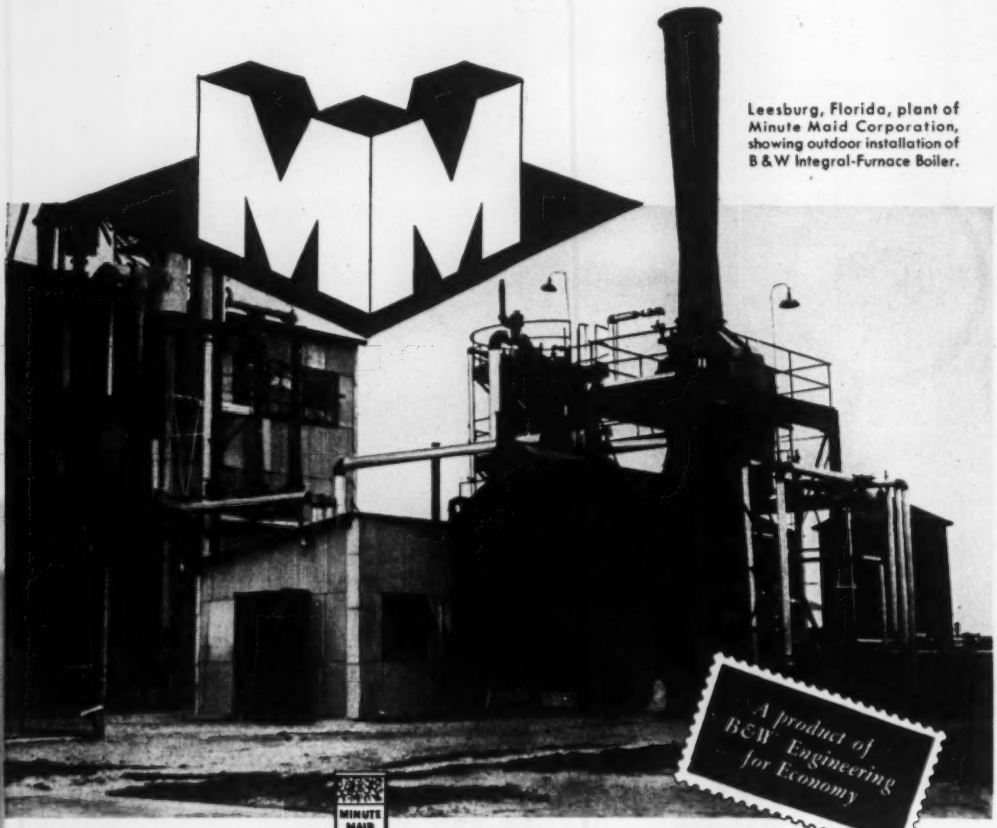


Leesburg, Florida, plant of Minute Maid Corporation, showing outdoor installation of B&W Integral-Furnace Boiler.

pioneering with B&W Steam

As leaders and innovators in the high-vacuum method of concentrating citrus juices . . . as part of a thriving Florida industry, expecting a 35% growth over the next three years . . . Minute Maid Corporation appreciates the importance of economical first-cost, and operation of its equipment at peak-level efficiency.

For example, Minute Maid's modern Leesburg, Florida, plant is equipped with a new B&W Integral-Furnace Boiler, Type FF. Rated at 46,000 lb. per hr. of dependable, low-cost steam, this highly efficient unit is oil-fired by B&W steam-atomizing Y-jet burners. And the entire unit is installed out of doors, at considerable first-cost savings. Minute Maid reports performance in keeping with their highest expectations.

Remember—when planning your company's next expansion, modernization, or new plant—that the B&W Integral-Furnace Boiler family includes designs ranging from as little as 2,800 lb. of steam per hr. up to 350,000 lb. per hr., and larger. The Babcock & Wilcox Company, 85 Liberty Street, New York 6, N. Y.

BABCOCK & WILCOX

G-494

THE EDITOR'S PAGES

• INSPECTION TRIPS to actual installations are popular features. In fact, we enjoyed one just last evening. That it was generally popular is indicated by the fact that the attendance at the group's usual meetings often runs around 50 (sometimes less) but that nearly three times that number went to a lot more trouble and spent more time to attend the inspection trip (which took the place of the regular meeting) in an out-of-the-way location . . . . . Articles in HPAC offer you many "inspection trips" to actual installations throughout the country, at a minimum of time and effort on your part — "trips" conducted by outstanding authorities on the subjects you're interested in. Don't miss the information and the help these opportunities offer you.

DISCUSS POWER SUPPLY FOR AIR CONDITIONERS

REPRESENTATIVES OF the Air Conditioning & Refrigerating Machinery Association met last month with the transmission and distribution committee of the Edison Electric Institute to discuss problems of power supply for packaged air conditioners.

In a statement on the subject by R. A. Gonzalez, of the Airtemp Div., Chrysler Corp., it was stressed that the ACRMA is vitally interested in three major questions:

1) Voltage variations in excess of 10 percent have occurred in a great many cases and over long periods. Is it proposed to take corrective measures soon or is it proposed to make some larger figure the allowable tolerance for voltage variations?

2) The problem of phase unbalance is, like these other matters, better known to the power generating than to any other one industry. The electrical industry deals with it, presumably figures it out in advance and then checks and tests for it as part of the operating procedures. What is the situation regarding the allowable variations and plans for correction?

3) Distribution voltage increases are quite suddenly announced as accomplished facts, although motor and allied equipment for the increased voltages are not in production. Whereas voltage increases are announced in some areas, we still have to deal with all the 200, 208 and 220 volt characteristics that are being supplied in other areas. In addition to the loss of painfully-earned standardization, there remain the problems of both existing and new equipment. The power generating industry has a great reputation for service and dependability; that reputation depends in the future on how just such problems as are discussed here are handled — particularly from the customer expense angle on burned out motors and starters.

In another part of the statement, Mr. Gonzalez said that the air conditioning industry feels it has had a part in making better lighting — as advocated by the power generating industry — possible. Higher lighting loads require air conditioning to remove the increased heat and preserve livable conditions in the stores, shops, banks and offices that have availed themselves of the benefits of improved and increased lighting, he pointed out.

W. L. McGrath, of the Carrier Corp., said that the problems from the viewpoint of the manufacturer of packaged air conditioning equipment could be divided into five categories:

1) Problems arising from service voltage standards and particularly recent revisions of them.

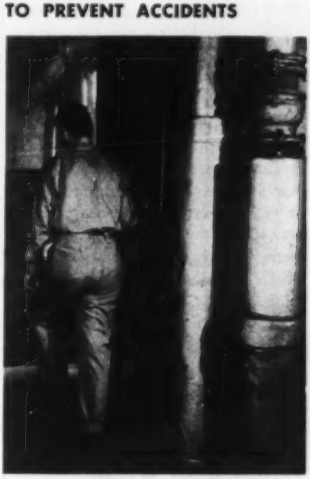
2) Problems arising from local variations in power service characteristics.

3) Problems arising because of inadequate motor protection.

4) Desired power characteristics for various sizes and types of equipment.

5) Long-term design objectives.

TO PREVENT ACCIDENTS



THE POSSIBILITY of burns where a vertical pipe line conveying 350 F ash passes within a few inches of a handrail has been averted at a power station by insulation, the Industrial Mineral Wool Institute reports. The 8 in. line was covered with ½ in. molded type insulation and a ½ in. layer of mineral wool cement up to 6 ft above floor level. The insulation was finished by covering the mineral wool cement with a single layer of asphalt paper and 10 oz canvas, which was glue sized and painted

PROPOSES NEW RATE FOR INDUSTRIAL GAS

THE COMBINED NEEDS of defense production and the civilian economy make imperative a change in the gas rate structure in industrial states so as to provide for two types of rates, a leading producer of industrial gas equipment declared last month.

Frederic O. Hess, former president, Gas Appliance Manufacturers Association, urged state utility commissions to provide an upward adjustment in rates for those factories to which a firm; year around supply of gas is essential, while maintaining present rates for other industrial users. Rates for household consumers would remain the same, he said.

Mr. Hess, who is also president of the Selas Corp. of America, designer of special heat processing equipment for heavy industry, explained that at present most industrial gas users get the fuel at a relatively low rate through "interruptible supply" contracts. Such contracts allow the utility to interrupt the supply to those users when necessary to do so in order to meet space heating demands. Naturally, he added, a factory operating under such a contract must be prepared with facilities for using a standby fuel.

"These contracts are an economic necessity brought about by the seasonal nature of gas loads," he said.

"But recent technical progress in gas equipment for industry has created many important processes which cannot readily employ a substitute fuel, and in those cases a 'standby' alternative is impractical or impossible."

CONSTRUCTION AWARDS PRESS 1950 TOTAL

THE EIGHT-MONTH total of construction contract awards in the 37 states east of the Rockies was "a strong 17 percent" ahead of the corresponding period in 1950 despite slight decreases in August as compared with July, according to the F. W. Dodge Corp.

The figure of $11,450,750,000 for the first eight months of 1951 pressed closely to the $14.5 billion total for the entire year of 1950.

PARENTS IGNORANT OF SCHOOL HEATING

MORE THAN HALF of the parents in the United States with children under 18 are ignorant of heating conditions in their schools, despite the important effects these conditions have on a child's comfort, performance and health, according to a nationwide study made for Minneapolis-Honeywell Regulator Co.

H. C. Jenkins, director of Honeywell's school division, said tests have shown that in many school buildings temperatures start climbing when classes begin and reach a high point in the middle of the afternoon, due to body heat, antiquated heating equipment, improper temperature controls and poor attention to operation. About 1:30 p.m., the old familiar yawning, drowsy period begins. Teachers loose the attention of their classes through no fault of their own. The children, in turn, lose valuable hours of instruction. But is there any reason why some 30 children in one classroom should be expected to remain alert and attentive when the temperature goes up as high as 85 deg?, he asked.

"QUOTE"

"Air conditioning has become an important and integral part of the life of America. Not only is it an essential element in the manufacture and distribution of many products vital to the national economy, but it is also a competitive commercial necessity for a large portion of the nation's retail and service industries. Increasingly it is becoming accepted as a necessary component of the American home."—WILLIAM B. HENDERSON, Executive Vice President, Air Conditioning & Refrigerating Machinery Association, at a meeting of a committee of the Edison Electric Institute.

UNITS HANDLE IBM MACHINE COOLING LOAD

AN UNPREDICTABLE cooling problem posed by heavy heat-producing calculating machines which may be moved from one part of a new insurance building to another, has been solved by an unusual mating of two different types of air conditioning apparatus, according to the Carrier Corp.

The completely air conditioned (315 ton) New Hampshire Fire Insurance Co. building, Manchester, N.H., has installed its IBM calculating equipment in one of the rooms on the first floor. But since the calculating machines are completely self-contained, they can be moved to other locations in the building, which would radically change the air conditioning load both in the space they were moved to and the room that was vacated.

To handle any possible future changes without alterations in the built-in central system air conditioning, two packaged air conditioning units — sized to take care of the heat from the calculating machines alone — were prescribed. The units, which are also completely self-contained, will be moved wherever the IBM equipment goes.

Cram & Ferguson were the architects, the consulting engineer was Buerkel & Co., Inc., the general contractor was the George A. Fuller Co., and the mechanical contractor was C. H. Cronin, Inc.

STATISTICIANS MATCH WITS AGAINST WEATHER

THE STORY OF HOW an oil company's statisticians match their wits against the vagaries of the weather in order to help keep fuel oil supply and demand in balance is told in a recent issue of *The Flying Red Horse*, magazine of Socony-Vacuum Oil Company, Inc.

Exhaustive studies of the weather and its effects on petroleum consumption are vital in preparing for the heating season. Socony-Vacuum pioneered in this field, A. J. McIntosh, company economist, having originated this work 20 years ago.

The article describes the tremendous effect of the weather on petroleum consumption. If last year's winter had been 6 deg colder than normal, this country's consumption of heating oils would have been 38 million barrels greater than it was.

An extremely mild winter brings problems, too. A warm autumn gives no assurance of a warm winter. Therefore, to protect its customers, the oil industry must adhere to refinery schedules well into the winter, even though continued warm weather causes sharp oversupply.

The article says that for the United States as a whole the weather now affects about 57 percent of total kerosene consumption, 59 percent of all distillate fuel oils, and about 13 percent of all residual fuel oils.

AGA REPORTS ON GAS SALES

TOTAL REVENUES from sales of gas by utilities for the second quarter of 1951 were $515 million, an increase of 10.6 percent over the like quarter of 1950, the American Gas Association has reported. Revenues from industrial sales represented the highest percentage gain, rising 21 percent. Residential gas revenues were up 7 percent and commercial gas revenues gained 5.1 percent over a year earlier.

In the 12-month period ended last June 30, total revenues from utility gas sales were $2,094,000,000, an increase of 15.4 percent over revenues in the previous 12-month period.

RADIO PROGRAM TREATS OF ENGINEER SHORTAGE

A SPECIAL PROGRAM dramatizing the nation's critical need for engineers will be featured on *Adventures in Research*, Westinghouse Electric Corp. radio science show broadcast to over 300 stations in the United States and abroad. It will highlight the role of the engineer in the technological growth of the nation and emphasize the present critical shortage of technical manpower. Estimates indicate that by 1954 the number of engineering graduates will be 40 percent below the minimum requirements of 30,000 a year.

The special program will be broadcast during the week beginning Sunday, November 25.

NEW

HEAT SAVING EFFICIENCY

with Mundet 85% Magnesia

Send for Complete New Catalog

Now available in pipe covering and block insulation, Mundet Custom-Molded 85% Magnesia permits new heat-saving efficiency.

You benefit from these advantages when you use Mundet 85% Magnesia Insulation.

- ***Easier to Apply***
  It cuts easily and cleanly, even without canvas support. No chipping, crumbling or "powdering." Blocks score cleanly.
- ***Lighter Weight***
  Only 11 lbs. per cubic foot density. Even larger sizes and thicknesses are easy for one man to handle.
- ***Controlled Uniformity***
  Precision manufacture on the latest type of equipment insures uniform standards.
- ***More Durable***
  Greater "ductile strength" is built into the insulation. It does not "powder," settle or disintegrate even with heavy vibration. It withstands handling and may be removed and reapplied if necessary.
- ***Does not Shrink or Warp***
  Steam or water leakage does not affect it. It does not shrink or warp even after soaking.
- ***Attractive Smooth Finish***
  No unsightly, inefficient "bagging." Mundet 85% Magnesia insulation retains its neat appearance and effectiveness.
- ***Precision Pipe Fit***
  No spaces are left for the escape of heat. The whole heated surface is snugly enclosed.

Write for specification information and recommendations. Mundet Cork Corporation, Insulation Division, 7113 Tonnelle Avenue, North Bergen, N. J.

Mundet district offices are conveniently located coast-to-coast.

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CINCINNATI 2
427 West 4th Street

DALLAS 10
601 Second Ave.

DETROIT 21
14401 Prairie Avenue

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INDIANAPOLIS 4
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800 E. Bay St.

KANSAS CITY 7, MO.
1401 St. Louis Avenue

KNOXVILLE
1221 Grand Avenue

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(Maywood)
6116 Walker Avenue

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315-25 N. Front Street

NEW YORK 17
331 Madison Ave.

PHILADELPHIA 39
856 N. 48th Street

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3176 Brannon Ave.

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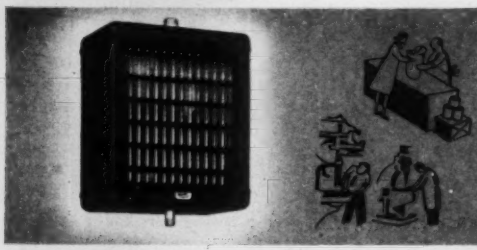
35 Booth Avenue, Toronto

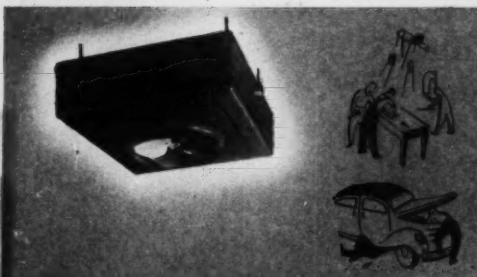
INSULATION FOR HIGH AND LOW TEMPERATURE

HEAT — as, when, and where you want it



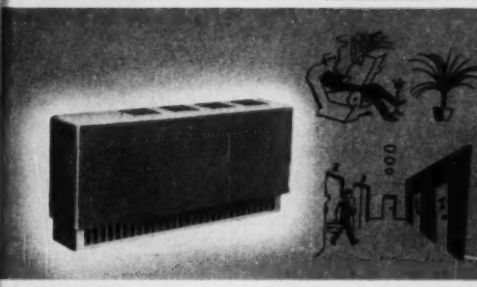
For Stores, Shops, Factories . . .
PROPELLER FAN UNIT HEATERS

Standard Webster-Nesbitt suspended unit heaters for quiet, economical working-zone comfort with easy controllability. Rugged, compact, efficient, incorporating standard or low-temperature nonferrous heating elements of extended fin-and-tube type. Nine basic models in capacities from 34,700 to 338,000 B.t.u. Publication WN-126.



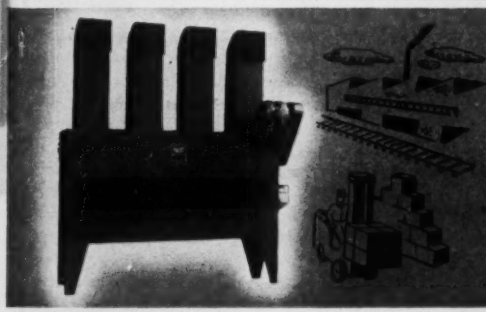
For Factories, Garages, Doorways . . .
LITTLE GIANT UNIT HEATERS

Downblow propeller fan units with blower fan performance, combining wide selectivity and versatility. Seven basic sizes: four larger draw-through models discharge a high-velocity vertical or horizontal downblow; three smaller blow-through models discharge vertically downward from lower mounting heights. Non-ferrous standard or low-temperature heating elements. Capacities from 23,900 to 348,000 B.t.u. Publication WN-134



For Vestibules, Lobbies, Corridors . . .
SERIES R UNIT HEATERS

Attractive, widely flexible cabinet units with low-speed belt-driven centrifugal fans and non-ferrous heating elements. May be installed as a vertical or horizontal floor, wall, or inverted-type unit, where appearance and concentrated heat are essential. Four unit sizes: 2, 3, 4 or 5 fans. Steam heating capacities from 158 to 588 e.d.r.; air deliveries, 518 to 1890 c.f.m. Publication WN-133.



For Factories, Warehouses, Hangers . . .
GIANT UNIT HEATERS

Blower-type Giants for handling large quantities of air at relatively low final temperatures. Available in nine sizes for floor, wall, and ceiling mounting. Three types of control: Standard (motor control), Thermadjust (by-pass control), Valve Control. Capacities range from 2550 to 18,100 c.f.m. at final temperature, and 101,000 to 1,008,000 B.t.u. per hour. Publication WN-128.

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Made by **JOHN J. NESBITT, INC., PHILA. 36, PA.**
Sold by **WARREN WEBSTER & CO., CAMDEN, N. J.**

Webster Nesbitt
UNIT HEATERS

"Open for Discussion"

• How about expressing your views on one of the articles in this month's issue of HPAC, for publication in these pages? Your comments on a controversial point, or additional information based on your experience, would — we know — be interesting and helpful to others. Or perhaps you'd like to say a little on some other matter of importance to plant engineers, building engineers, operating and maintenance men, heating, piping and air conditioning engineers or contractors? We follow here each month the practice at engineering society meetings of providing an "open for discussion" period. You are cordially invited to participate. Address the Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

RAISLER IS CONTRACTOR ON CHRYSLER BUILDING EAST

The article describing the air conditioning of the new Chrysler Building East, New York City, published in the September HPAC, failed to state that the Raisler Corp., New York City, is the heating and air conditioning contractor on this job. The omission is regretted.

Louis K. Berman, Raisler's president, is a life member of The American Society of Heating and Ventilating Engineers.—The Editors.

EFFECTIVE TEMPERATURE SCALE NEEDS STUDY

I have read with much interest — but also with some concern — the article *Equivalent Temperature: What It is — How It's Measured*, by Dr. Thomas Bedford, appearing in the August 1951 HPAC. The article has much to commend it and the author is to be congratulated on the interesting researches which he has conducted.

However, my concern (which is shared by Professor F. B. Rowley) is with the interpretations which the author has placed upon researches conducted by Professor Rowley, Dr. W. E. Snyder, and me, and reported in the article *Comfort Reactions of 275 Workers During Occupancy of Air Conditioned Offices*, published in the ASHVE Journal section of HPAC in June 1947.

In Dr. Bedford's article he states "There seems to be no doubt that for normal indoor conditions in Great Britain equivalent temperature is an excellent scale of warmth. . . . This view is supported by the findings of Rowley and his colleagues (1947), for their data suggested that the feelings of warmth of their subjects, at dry bulb temperatures of 70 to 80 F and effective temperatures of about 65 to 75 F, were more closely related to dry bulb temperatures than to effective temperatures. No influence of relative humidity was observed."

It is true that the data presented could lead to these conclusions, but only if the qualifications which we made in the original article are disregarded. To quote the last paragraph of our own article: "It is emphasized that the results of this study are based upon a limited range of temperature and humidity and that a considerable period of time elapsed between the taking of the data and the analysis of the data. Furthermore, the original data were not taken by the authors and were not taken with the present analysis specifically in view. While it does appear that the effective temperature scale needs revision, it is not recommended that this report be used as a basis for that revision. It is felt that the results presented herein are not in themselves conclusive evidence. They should not be taken as other than indicative of some need for a revision based upon more complete information."

In our article, we did not present any incontestable conclusions and specifically recommended laboratory experimentation as an initial step in reopening a study of the effective temperature scale and the comfort charts. In the ensuing discussions, published in the Transactions of The American Society of Heating and Ventilating Engineers, we stated that the analyses made yielded results in conflict with established concepts of effective temperature and comfort reactions, because of either (1) limitations in the present E. T. scale or, (2) limitations in the data, and that we hoped our contribution would act as a catalyst toward investigations which would prove or disprove the unusual results our analyses showed.—R. C. Jordan, Professor and Head, Dept. of Mechanical Engineering, University of Minnesota.

PROCESS PIPING ARTICLE IS TIMELY, VALUABLE

Carl B. McLaughlin should be commended by HPAC's readers for his timely article, *Piping Materials for Chemical Processes*, in the October issue. It deserves a careful reading and filing for reference.

Those who are interested in any of the many phases of this subject are bound to find the article to be comprehensive and practical. It is gratifying that the author did not "select a single phase of the subject" but chose to "cover the field broadly, thus reviewing certain useful data and developments that may have been overlooked by some readers." Most of the author's points are illustrated realistically by concrete examples.

Of particular interest are the cautionary reminders and admonitions. If heeded, they should be provocative enough to stimulate detailed studies instead of casual decisions when materials, joints, fabricating processes, etc., are being evaluated for chemical process piping.

Too much emphasis cannot be placed upon the vital importance of providing detailed information about the application of a material and all

conditions surrounding its use whenever corrosion data is sought. Sketchy information is worse than useless and can lead to some horrible results. Mr. McLaughlin treats this phase of the subject effectively. Equally important are his comments about the need for "broad, intelligent and continuous testing programs" in the case of larger users.

Referring to the paragraph about lap joints, the writer of these comments would not recommend the use of stub ends which have round corner laps, regardless of the size of radius on the inside corner. Instead, personal preference would emphatically endorse Mr. McLaughlin's statement that "a stub end with square corners would be more ideally suited" for chemical process piping. Further, the faces of the lap joints should be machined to suit the particular type of gasket material being used.

The use of lap joints on such piping materials as stainless steel, nickel, monel and some others frequently can effect economies because an ordinary carbon steel lap joint flange can be used since it does not come into contact with the fluid inside the piping. —G. W. Hauck, Manager, Engineering Sales, Crane Co., and a member of HPAC's Board of Consulting and Contributing Editors.

PLANT WILL BE ENVY OF OTHER OPERATORS

The new and modern heating plant for the Illinois Institute of Technology, described by L. C. Hardison and W. J. Parduhn in the August HPAC, is a striking example of what can be accomplished by careful planning and vigilance. All too often, an academic building expansion program completely ignores the capacity of the central heating facilities, and the expansion program proceeds to a critical point requiring the constant overloading of existing boiler capacity. Occasionally this practice results in a complete breakdown of the old system.

At Illinois Tech, the authors outline an orderly procedure of stepping up the capacity of the heating facilities in direct relation with the new requirements. The flexibility of the plant described is unusual and will be the envy of other operators. The use of fuel gas and pulverized coal at different seasons gives opportunity to compare these two fuels.

Another desirable factor is the ability to analyze carefully steam consumption in the new buildings vs. the old buildings on the campus by means of the installation of condensate meters. Proper analysis of this information is of inestimable value to the operators and makes it possible for management to modify existing heating installations to conform with the lowest cost.

As the Illinois Institute of Technology is located in a densely populated area, it is difficult to understand why pulverized fuel was chosen. Even with the cyclone fly ash precipitator, it is probable that considerable fly ash will escape and be an irritant to community relations. A 200 ft stack is described as a part of the installation. Advantage might have been taken of the induced draft fans installed to reduce considerably the height of the stack and thus improve the general campus appearance.

After the plant has been in operation for a considerable length of time, operating data resulting from this operation will be most interesting and it is to be hoped that the authors will be gracious enough to publish this information in a subsequent article.—Lester S. Ries, Superintendent, Oberlin College.

Reply by Authors—Mr. Ries poses two questions about our new heating plant, which we feel can be answered to his satisfaction.

There are several answers to his question about choosing pulverized coal for use in a semi-residential area:

1) The pulverized coal plant was available, complete, at the time when it was badly needed.

2) We believe that because of our pulverizer, we can produce steam at a fuel cost that cannot be beaten in this area. Test runs of nearly a dozen low cost coals during the past heating season indicate that we will be able to purchase fuel for our plant at about 12.5c per million Btu net or 23c per million Btu delivered. This will amount to a total fuel cost of about 25c per 1000 lb of steam for the coming year.

3) There has been no complaint of fly ash during the past year and a half. The plant is certainly much less objectionable than the old one, and (we believe) than any other in the neighborhood. This is due to the combination of a good precipitator and a 200 ft stack.

The second question, "Why the 200 ft chimney?", has already been partially answered. It is common knowledge that stacks for modern plants serve very little purpose other than that of getting combustion products up high enough to keep them from being objectionable. We think that the stack is paying for itself rapidly by allowing less expensive fuel. Also — though we may be prejudiced — we think it is a good-looking stack.—L. C. Hardison and W. J. Parduhn, Illinois Institute of Technology.

NOISE RATINGS FOR FANS

Referring to R. A. Gerlitz' comments on testing fans for noise level, in the October HPAC, to obtain a scientific knowledge of sound, it is necessary to be equipped with sound analyzing equipment (as many laboratories are) which, when motorized, causes the test time element to be negligible.

Engineers usually like to deal with facts and this would not be so if symbolic ratings for noise were used, as they certainly are dependent on the human element.

Rating in phons would mean rating from the Fletcher & Munson curves, which are based on annoyances as many people hear them.—A. Currie, Chief Research Engineer, L. J. Wing Mfg. Co.

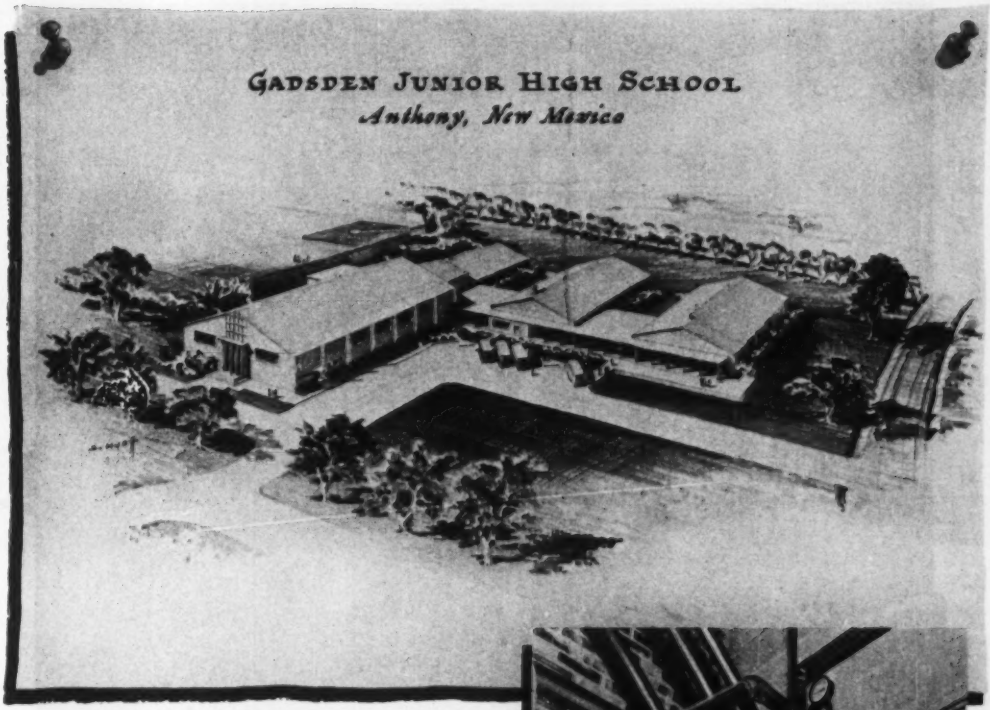
GIVES DOWN-TO-EARTH INFORMATION ON SEALS

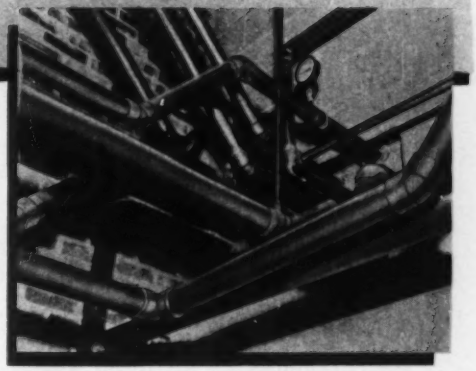
After reading the article, *Using Mechanical Seals for Centrifugal Process Pumps*, by Dan R. Rankin, published in the October HPAC, I am of the opinion that it is without a doubt the most down-to-earth article on mechanical seals that we have seen during the many years of manufacturing these units.

It states in simple and clear language the difference between the packing type and automatic type of seal pump and brings out the advantages and disadvantages that should be taken into consideration.—K.A. Beier, Chief Engineer, Schwitzer-Cummins Co.

* * * *

Watch for the complete Directory Section to be published in the January issue, which will classify heating, piping and air conditioning equipment, give complete addresses, and list trade names.





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That's why 13,000 feet of Revere Copper Water Tube were used for the hot and cold water lines . . . in the heating system . . . and as vent stacks in the Gadsden Junior High. Centuries of use have proved copper endures. Revere Copper Water Tube is non-rusting and comes in straight lengths of 12′ and 20′ as well as 60′ coils to suit every type of installation. The longer length can be bent to save fittings. The solder or compression fittings used with Revere Copper Water Tube make it possible to use a thinner wall tube than when threaded fittings are used, resulting in a substantial saving in metal and easier workability in inaccessible places.

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"WE ARE PROUD OF the amount of building we procured for the price," said Mr. Rex F. Bell, Superintendent, Gadsden Independent Schools, when he inspected the newly-completed Junior High at Anthony, New Mexico. Architect—Truman J. Mathews, Santa Fe, N. M.; Consulting Engineers—Davis & Foster, El Paso, Texas; General Contractor—Gilchrist Const. Co.; Plumbing Contractor—Ruiz Plumbing Co., Inc., both of Las Cruces, N. M.; Distributor—Momsen Dunnegan Ryan Co., El Paso, Texas.

(insert photo) IDEAL FOR TIGHT SPOTS LIKE THIS—Revere Copper Water Tube takes up less space than bulky, threaded pipe and the fittings used do not require a lot of room for swinging a wrench. Tube sizes used range from ½" to 3" in diameter.

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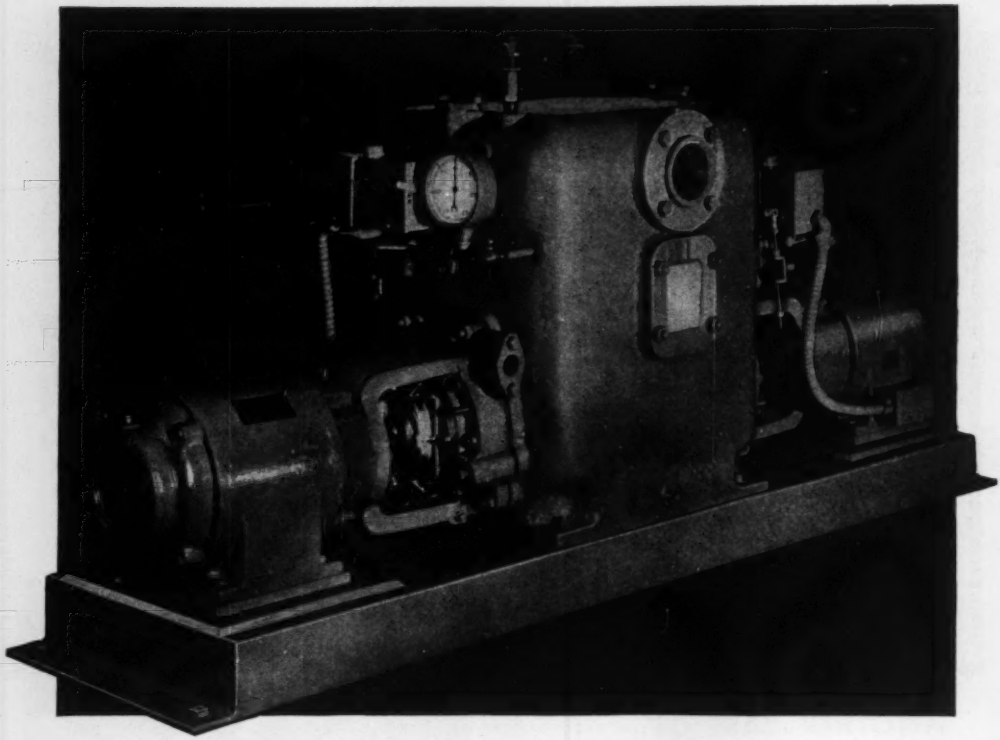

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High Temperature — High Pressure Piping

Heavy Wall 2¼% Chrome-1% Moly Pipe Used at Commonwealth Edison's Ridgeland Station

By W. S. Woolsey
Senior Engineer, Construction Dept.
Commonwealth Edison Co.

COMMONWEALTH EDISON Co. and its affiliate, Public Service Co. of Northern Illinois, have been forced — like other electric utilities throughout the country — into a very rapid expansion program since the war. In the nine year postwar period, 1,434,000 kw will have been added by the fall of 1954. This will bring the total capacity to 3,722,000 kw — approximately double that prior to World War II and as much as that of the entire country in 1909!

Commonwealth Edison's new Ridgeland station, located west of Chicago, will provide 600,000 kw (four 150,000 kw units) of this added capacity. At the present time, two units are in service and work has just started on the substructure for the other two. Design for this new station has progressed in line with the American way of continually seeking something new and better. Previous to the Ridgeland station installation, our high pressure units were designed for 925 F and 1200 psi steam, while at Ridgeland the units have been designed for 1050 F and 1800 psi steam to gain the added efficiency resulting from higher temperature and increased pressure.

Considerable investigation was required to find the best commercially available low alloy steel pipe for the higher temperature steam at Ridgeland station. This higher temperature steam requires new creep resistant piping materials to replace the previously used 1 percent chromium-½ percent molybdenum pipe. Experience has shown that 1000 F is about the maximum for 1 percent chrome-moly pipe, since accelerated creep is likely above that temperature.

A 2¼ percent chromium-1 percent molybdenum alloy steel pipe (ASTM

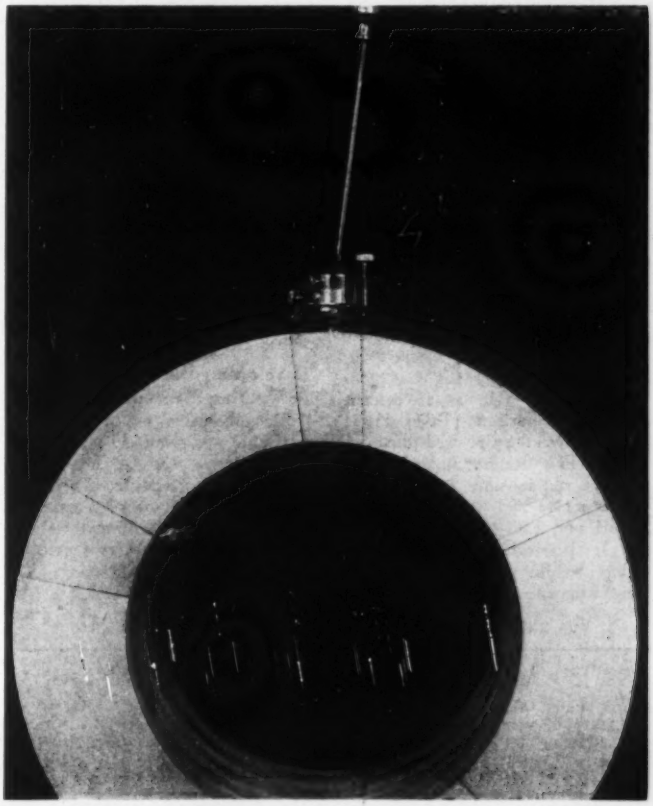


FIG. 1 — POSITIONING RADIUM CAPSULE for gamma ray pho'ography of the welded joints in the piping was simplified by this specially-developed device. The adjustment head on the outside allows accurate positioning of the capsule holder within the pipe and only a ½ in. opening is required in the pipe wall

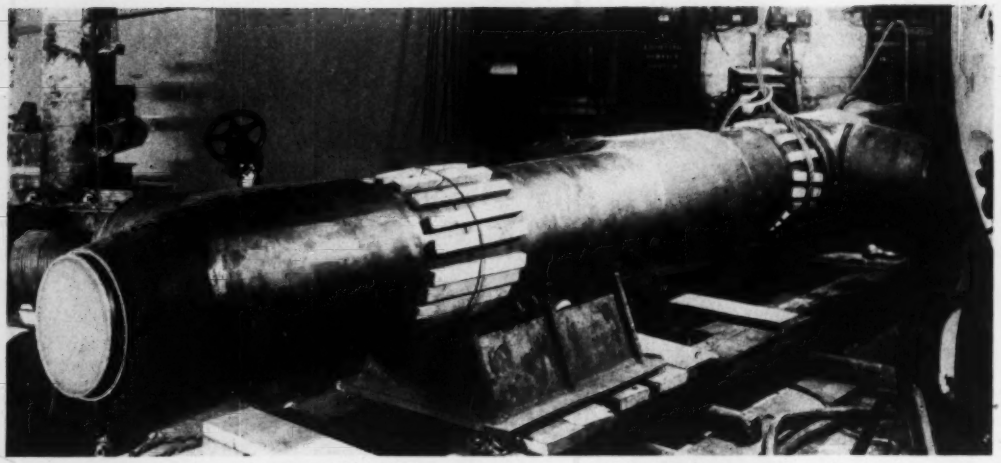


FIG. 2 — MAIN STEAM HEADER, showing wooden protectors for slings to avoid causing any stress raising breaks on the pipe surface and metal cap tacked to ends of each pipe at fabricator's shop and removed just prior to alignment of the pipe for welding.

specification A-213, T22) was decided upon for the main steam piping system as the most economical and satisfactory for our application. One percent chrome-½ percent moly pipe was chosen for the high temperature extraction steam piping. The remainder of the piping system uses seamless carbon steel pipe of various wall thicknesses. The wall thicknesses vary from standard thickness for the service water system to schedule 160 for the boiler feedwater piping system, where the maximum operating pressure is 2370 psi and the temperature is 480 F.

New Piping Problems Are Presented

The use of 2¼ percent chrome-1 percent moly pipe presented entirely new concepts for Commonwealth Edison Co., as is evident when a comparison (Table 1) is made between the pipe used previously for Fisk station unit 18 and Calumet station unit 7 (1 percent chrome-moly) and Ridgeland station units 1 and 2 (2¼ percent chrome-moly). It is evident that new fabricating, welding and erection problems are encountered when such heavy wall pipe is used (over twice the wall thickness). These differences and their solutions are described briefly in the ensuing paragraphs.

Different Method of Pipe Manufacture

The pipe used previously was manufactured by piercing and rolling a steel billet to desired size, whereas the Ridgeland station high pressure steam pipe, due to its thickness and close wall tolerances, was produced by machining and boring a forged steel billet. Large lathes were used to bore the inner surface of the forged billet and machine the outer surface. Due to this method of manufacture, this pipe is called "hollow bored."

Developing the Welding Procedure

Since the actual use of such heavy wall pipe was relatively new, one of the first steps was the development of a welding procedure. To accomplish this, a wood mock-up was made incorporating five different welding grooves with 3/16 in. root gap and various angles of beveling. The mock-up was checked and tested by experienced welders, fabricators and designers. The approved welding groove met the requirements of all three groups, taking into account sufficient working opening for the welder and yet requiring the least amount of weld metal. The selected groove incorporates a chrome plated back-up ring of the same material as the pipe.

The next step, after agreement as to the type of weld groove, was trial of the various types of electrodes. A lime coated rod that gave a weld deposit having the same composition as the base metal was selected (ASTM specification A316-48T, classification No. E-9015).

Stress Relieving a Major Problem

Stress relieving presented a major problem in obtaining ample capacity to heat treat the weld zone uniformly. A simulated weld was set up by clamping two short pieces of 3 in. wall pipe together. Thermocouples were installed at various locations. Preheating and stress relieving cycles were performed using gas heating rings, stranded copper induction heating coils, and water cooled copper tubing induction heating coils.

The most uniform heat control with the least use of electricity was obtained with 500,000 circular mil stranded copper wire induction coils. The wire was jacketed with 1/16 in. woven asbestos tubing and separated from the pipe by two layers of ⅛

TABLE 1 — COMPARATIVE THICKNESSES of pipe walls

Nominal Pipe Size, In.	Fisk station unit 18 Calumet station unit 7			Ridgeland station units 1 and 2		
	OD	ID	Thickness	OD	ID	Thickness
14	14.0	11.188	1.406	17.730	11.188	3.27
10	10.75	8.500	1.125	13.578	8.500	2.539
4	4.50	3.438	0.531	5.760	3.438	1.161
1	1.315	0.815	0.250	1.515	0.815	0.350

in. asbestos paper. With this arrangement, the stress relieving temperature of 1350 F and heating and cooling rate of 300 F per hr could be very closely controlled.

Gamma Ray Inspection Equipment and Techniques

Due to the high pressure and the importance of sound welds, gamma ray pictures were taken of each weld as a check of weld quality. After a study of welding records of other fabricators, it was decided to inaugurate a program of taking a picture after the first inch of weld metal had been deposited — since most defects requiring repair occur in root passes. This proved to be a very advantageous move as, of the few defects that occurred, all were in the first inch. The savings resulting from following this method over having to dig down through over 3 in. of metal are obvious. Gamma ray pictures were also taken after completion of the weld.

Still another development in gamma ray picture taking was the method of placing the radium capsule inside the pipe. On previous jobs, a 3 in. diameter opening was located near the weld for this purpose. This opening was closed by pulling a flanged plug up onto a counterbored seat and welding the neck of the plug to the outer wall of the pipe. It was felt that this large a hole in such high pressure and temperature piping was objectionable. Therefore, the first method tried was use of a six-wheeled buggy with spring steel guides for centering. This buggy was inserted into the open end of the pipe and positioned by the use of cables attached at either end. The location of the radium capsule was determined with a Geiger counter.

At about the time the buggy was fully developed, the idea of gamma ray holes was again considered, since uncertain pipe delivery made scheduling of gamma ray photography difficult. It was felt that a smaller inspection hole would be better, so that a new development came into effect. The size of the opening was cut to ½ in. IPS and a special jig (Fig. 1) for positioning the radium capsule was developed. The ½ in. opening was closed, after the pictures were taken, with a screwed plug of the pipe material. The plug and hole were threaded to provide a minimum of 1 in. of thread and the plug was seal welded at its junction with the surface of the pipe.

This gamma ray plug method was decided upon as best because it was difficult to position the buggy accurately, there was fear of the buggy becoming stuck in the pipe, and the erection could be expedited (since no open pipe ends were required for the buggy.)

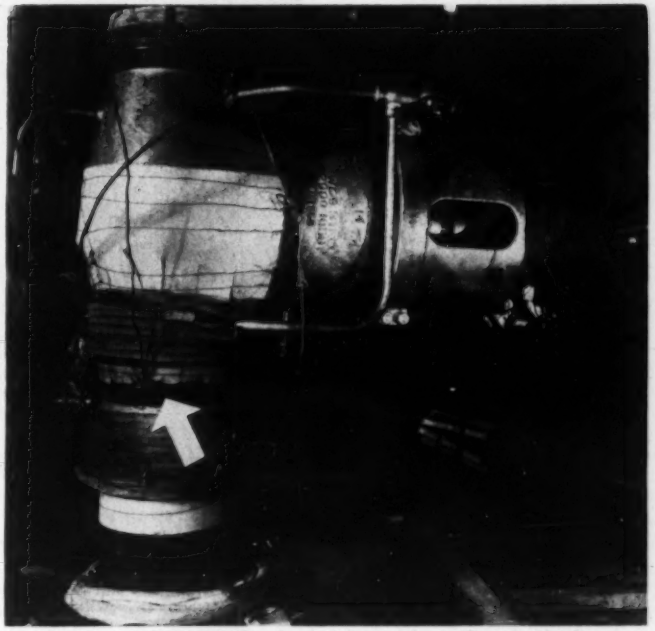


FIG. 3 — JOINT SET UP and tacked (arrow) for welding, showing large main steam valve and hollow bored pipe, stress relieving coils and thermocouple lead

Problems in Field Erection

After the above developments, the actual field erection was carried out with still more refinements and adaptations.

The first step in the field, upon receipt of material from the fabricator's shop, was to place the pipe in position and align it prior to welding. The piping contractor had to think in terms of larger and heavier lengths, since the average length was over 30 ft and weighed between 5 tons (10 in. hollow bored) and 8 tons (14 in. hollow bored). The heaviest piece was the steam manifold, which weighed about 12 tons. This forged manifold piece alone, shown in Fig. 2, cost over $19,000 to fabricate.

More thought had to be given to temporary supports for raising and positioning these pieces since all this work could not be accomplished with chain falls. Electric driven hoists were necessary; sometimes both drums of a hoist and chain falls were used to control the piece. The hoists were placed in a central location and the cables reeved through necessary blocks to do the job. Since in many cases the hoist was necessarily out of sight of the piece being raised, signals had to be given by means of colored electric lights at the hoist operated by pushbuttons at the piece. Extreme care had to be exercised in the handling of each piece in order not to mark it and cause stress raising breaks in the surface. Special wooden protectors were used to solve this problem, as shown in Fig. 2. After erection, the pipe was inspected for any stress raising marks, which were removed by grinding.

Cleanliness of the pipe was of great importance. Special metal caps, also shown in Fig. 2, were tacked to each end of the pipe at the fabricator's shop and removed just prior to alignment for welding. The method of manufacture (hollow bore) provided clean pipe internally.

When bending of the pipe was performed, the fabricator pickled and sandblasted the interior after bending to remove the mill scale and provide a clean surface.

Prior to field erection, the fabricator laid out the entire steam system and more than normal care was used in allocating the available lengths. In this way there was a minimum of waste pipe. At such a high cost per foot (as much as $285 per ft) this procedure was most necessary! All pipe was fabricated, except the closure pieces at the turbine throttle valves, from this layout. After all the pipe was erected, final closure measurements were made. In this manner, the last pieces fit exactly.

Field Welding of the Piping

Welding of the joints proceeded as previously described, except that it was learned that during preheating to 600 F expansion occurred and that the weld gap could be lost even with a properly fitted back-up ring. (Fig. 3 shows a joint set up for welding.) It was decided, therefore, to line up the joint and start preheat. By measuring the gap on the way up during preheat and tacking the joint when the proper gap was obtained (normally at about 400 F), this difficulty was solved.

The actual welding of the joint was done at 600 to 700 F. Each weld pass was cleaned by grinding and inspected for cracks before the next pass. It was decided that due to the possibility of thermal and erection stresses in the weld, the temperature of the joint should not be permitted to drop below 600 F until stress relieved at 1350 F. This meant that after the first inch of weld had been deposited, stress relieving was necessary before a gamma ray picture could be taken at 150 F. It was found that for 14 in. hollow bored pipe, 225 passes were necessary for a fixed vertical weld and 76 passes for a fixed horizontal weld. On 10 in. hollow bored pipe, 128 passes were necessary for a fixed vertical weld and 35 passes for a fixed horizontal weld.

Welding was performed with 1/8 in. electrodes at 85-115 amp and 20-24 volts for the first four passes, and 5/32 in. electrodes at 120-170 amp and 23-26 volts for the remainder of the weld. These settings gave good penetration and an easily handled arc. Beads were applied with a slight weaving motion. The rod consumption averaged 160 lb per 14 in. joint and 75 lb per 10 in. joint. Table 2 shows a breakdown of elapsed time per weld, and indicates the enormity of the task of welding hollow bored pipe. It was estimated from Table 2 that the cost of a 14 in. weld was $1625 and of a 10 in. weld was $1025. These are the costs of making the weld and do not include the erection cost.

FIG. 4 — GAMMA RAY PICTURE being taken of a welded joint. Film is wrapped around pipe, and end of special jig shown in Fig. 1 may also be seen. At left is one of the special insulated pipe support shoes

A preliminary survey showed that three stress relieving machines of adequate capacity would be required to handle the job in the time scheduled for the high pressure steam piping erection. Therefore, the welding and erection schedules were based on three simultaneous welds. The availability of material from the fabricator, the amount of work in erection prior to welding and the ultimate schedule requirements all pointed toward working the job as fast as possible to accomplish completion. Overtime or shift work was used as an economy measure in welding, since the requirements of keeping preheat temperature on at all times until a weld was stress relieved made continuous rather than intermittent welding desirable. This was true due to the cost of a stress relieving operator to hold the preheat temperature during "nonproductive" hours.

Three Machines Used in Stress Relieving

Stress relieving, as previously mentioned, was accomplished with 500,000 circular mil coils and induction machines. The three machines were placed at a central location and 750,000 circular mil cables were used as leads to the coils. The stress relieving coils were separated at the weld for preheating. Welding was performed with these coils used to hold the preheat temperature. A lead with a remote switch was devised to de-energize the stress relieving machine at the joint, since welding could not be performed with the machine on due to the magnetic field set up by the line coil. During the welding of the joint, the heat of welding retained the preheat temperature. Also, a lead with a remote rheostat was devised so that the welder could control his welding machine. These proved to be economical, since in many cases the machines were well over 100 ft away and at another elevation.

After completion of the weld, the coils were placed over the weld and stress relieving was carried out. Each joint was stress relieved at 1350 F and this temperature was held for 2 hr per 1 in. of wall thickness. The joint was cooled after stress relieving

by machine control at a rate not to exceed the prescribed 300 F per hr. Originally, 600 F was arbitrarily decided upon as the temperature at which ambient air cooling could start. Experience proved that at between 900 F and 1000 F air cooling without control could start as the permitted cooling rate was not exceeded because of the mass of the metal.

The only exception to the inductance coil method of stress relieving was the case of the 1 in. hollow bored pipe, which was both preheated and stress relieved with oxyacetylene torches.

Taking the Gamma Ray Pictures

Before gamma ray pictures were taken, the weld surface was ground smooth. A picture was taken after the first inch of each weld, and three pictures covering 120 deg each were taken after completion of the weld. (Fig. 4 shows the taking of an actual gamma ray picture.) This 120 deg spread was necessary to obtain proper focal distance.

Since a large number of pictures was involved, it was decided to develop them on the job. This saved the cost of travel time to a central photographic laboratory, and the status of the weld was thus known sooner. This permitted the remainder of the work to proceed without delay. The field developing laboratory proved exceptionally satisfactory.

It might be mentioned that a few experimental supersonic checks were made of welds, and that such a method may represent an improvement. However, it requires an extremely skilled operator to interpret results correctly and provides no permanent record that can be checked or reviewed at a later time. It would certainly be a money-saver if it could be adapted to the "first inch" check, with the joint still at 600 F temperature, but so far this does not appear feasible.

Cleanout of the Piping System

As a final step after the pipe was erected and welded and just before installation of the turbine closure pieces, the pipe was hydrostatically tested at 2955 psi. It was then blown out to get rid of dirt, rust or anything else that might be on the inside of the pipe at this stage of erection. This was accomplished with 400 to 600 psi steam for a period of 5 to 10 minutes continuous blow. Temporary piping carried the steam outside the building. This consisted of a 24 in. pipe header connected to 12 in. pipe leads which were butted to the hollow bored pipe ends and held by specially made clamps.

This blow-out procedure assured the cleanest possible piping system to the turbine. Since damaged turbine blades cause loss of efficiency during the life of the machine, the avoidance of damage due to contaminating materials left in the pipe is of the utmost importance.

TABLE 2 — ELAPSED TIME required per weld. Note that these are elapsed times and not man-hours

	Time, hr 14 in. pipe	Time hr 10 in. pipe
Install heating coils	4	4
Preheat (600 F)	2	2
Initial welding (1 in. to 1¼)	24	12
Stress relief (1350 F, hold and lower to 600 F)	8	8
Cool (600 F to 150 F)	12	10
Grinding	4	4
Gamma ray inspection	2	2
Readjust cables	2	2
Preheat	2	2
Final welding	48	24
Stress relief (1350 F, hold and lower to 600 F)	16	12
Cool (600 F to 150 F)	20	15
Grinding	16	16
Gamma ray inspection (three exposures)	78	27
Total hours of elapsed time	238	140

Insulated Shoes for Pipe Supports

Special insulated shoes, Fig. 4, were developed for pipe supports in horizontal runs where spring hangers were not used. Insulation of this pipe totals 5 in. in thickness (3 in. of high temperature insulation and 2 in. of 85 percent magnesia insulation).

Special 2500 psi valves had to be manufactured for this temperature. These valves weigh about 5 tons for the 14 in. size (Fig. 3).

Scope of the Job Performed

Unit 2 main steam system hollow bored piping consists of 92 ft of 14 in., 465 ft of 10 in., 84 ft of 4 in. (used for steam lead to turbine driven boiler feed pump) and 686 ft of 1 in. (used for steam to auxiliaries such as turbine oil pumps, evactors, hoggers, primers, sealing steam, etc.). Unit 1 hollow bored piping consists of 71 ft of 14 in., 259 ft of 10 in., and 633 ft of 1 in. Also, each unit has about 110 ft of 2¼ chrome-moly 10 in. schedule 160 pipe which is used as a steam supply to the low pressure turbine when operated independently.

Twenty-eight 10 in., seven 14 in., and nine 4 in. hollow bored welds, and seven 10 in. schedule 160 welds in the field were required for unit 2. Twenty-one 10 in. and five 14 in. hollow bored welds, and seven 10 in. schedule 160 welds were required for unit 1. All the joints were welded and stress relieved in the manner which has been described.

About 38 men were required daily to erect and weld the main steam piping system. This force included 15 pipefitters on erection of hangers and pipe and 20 pipefitters in the welding crew (10 per 12 hr shift). This welding crew, when not welding on aligned joints, fabricated and welded 1 in. hollow bored pipe and small valves. Also, they aided in wrapping joints and pulling leads for the next weld. This latter work was performed during regular working hours and only the actual welding was carried on into overtime hours. The three remaining men worked the stress relieving machines and not only stress relieved the main steam piping, but also other piping requiring heat treatment—such as boiler feed, crossover steam and extraction steam.

LISTS STEEL NEEDED TO BUILD A SHIP

THE IRON AND steel required to build a modern passenger ship — such as the S.S. Independence — totals some 16,000 net tons, according to one of a series of diagrams on steel requirements prepared by the American Iron and Steel Institute.

Of the total of 15,976 net tons of steel, the piping accounts for 761 tons. Ventilation accounts for 391 tons, and the pumps for 63 tons.

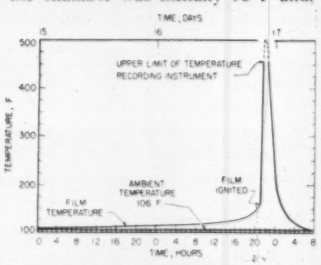
Spontaneous Ignition of Motion Picture Film

National Bureau of Standards tests have shown that spontaneous ignition of cellulose nitrate motion picture film can occur when such film is in an advanced stage of decomposition. In a government depository, large quantities of film are stored in vaults maintained at 70 F by an air conditioning system, and inspections have revealed no evidence of serious film decomposition

INVESTIGATIONS BY THE National Bureau of Standards have shown that spontaneous ignition of cellulose nitrate motion picture film can occur when such film is in an advanced stage of decomposition. Prior to this work, it was generally believed that nitrate film would not ignite spontaneously at temperatures ordinarily encountered in a film vault. Tests made by A. C. Hutton, of the NBS fire protection laboratory, and conducted in cooperation with the National Archives have provided the necessary information to prevent reoccurrence of the severe fire losses to film and storage facilities that have been experienced in recent years.

In New York City and adjacent areas during the abnormally hot summer of 1949, numerous fires occurred involving cellulose nitrate motion picture films. These fires started in processing and reclamation plants and in film storage facilities. Losses, other than those of real property, were great, the majority of the films destroyed being original negatives and master copies — some dating back to the "silent era." In studying storage conditions, the National Archives and NBS engineers found no evidence that the fires were due to the negligence of personnel or the careless use of cigarettes or matches; instead, the fires appeared to have originated through the spontaneous ignition of deteriorated nitrate films.

At the request of the National Archives, therefore, the National Bureau of Standards instituted an investigation of spontaneous ignition as an inherent hazard with nitrate film. Samples in various stages of decomposition were supplied by the National Archives for the purpose of simulating conditions which may have prevailed at the fire locations. These samples were stored in a special chamber, the temperature of which was controlled and recorded. Each film was packed in an individual can which was in turn wrapped in mineral wool to retain the heat of the exothermic decomposition reaction. The ambient temperature in the chamber was initially 95 F and,



TEMPERATURE BUILD-UP during the critical period in which a nitrate film under test at NBS ignited spontaneously is shown in this typical curve

at intervals, was increased by small increments, but always maintained below that of the reacting film.

At a chamber temperature of 106 F, one roll of film in the more advanced stage of decomposition was found to be increasing in temperature at an accelerating rate. On the 17th day of storage, with the chamber temperature still at 106 F, ignition of the film occurred. Its temperature at the time had reached 140 F. Other rolls of film under the same test had slower rates of temperature increase. With the chamber held at 120 F, another case of spontaneous ignition occurred when a roll ignited after self-heating to 150 F.

Self-ignition temperature is dependent upon a number of factors and therefore was not the same for any two samples. The lowest temperature leading to ignition was 106 F. Because the number of samples investigated was small, it is doubtful whether this is the lowest temperature at which a reel of deteriorating film will self-ignite.

Air Conditioning Prevents Deterioration

The results obtained in the NBS tests indicate that good film does not self-ignite at ordinary storage temperatures. In one of the government film depositories large quantities of cellulose nitrate film have been stored in standard vaults in which the temperatures are maintained at about 70 F by an air conditioning system. Several inspections of film in these vaults did not reveal evidence of serious film decomposition. This indicates that relatively low temperatures will materially decrease the possibility of a fire by spontaneous ignition and at the same time preserve the film for its intended purpose.

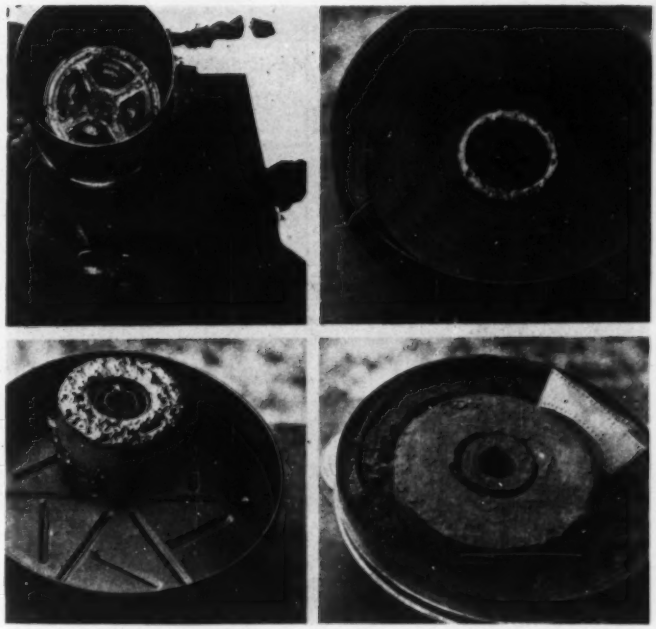
The logical approach to safe storage is the removal of all film showing signs of deterioration. Such film

can readily be found by scheduled inspections of stored film stocks. Inspection personnel should be trained to recognize decomposing film by appearance, and to classify its condition according to the following categories. In the first stage of deterioration the photographic portion usually shows an amber discoloration with fading of the picture image. In the second stage, the emulsion becomes adhesive and film convolutions tend to stick together during unrolling. Film in the third stage of deterioration has portions which are soft, contains gas bubbles, and emits a distinctive noxious odor. In the fourth stage, the entire film is soft; its convolutions are welded in a single mass, and frequently its surface is covered with a viscous froth. The same noxious odor, only stronger, is in evidence. In the fifth and final stage, the film mass degenerates partially or entirely into a brownish acrid powder.

Deteriorated film in the first and second stages is photographically reproducible. When the subject matter is important, the film can be copied and the original destroyed. If the material is not valuable, the film should be destroyed at once. Adhesiveness prevailing in deteriorating film often causes the emulsion to become detached from the base while unrolling. Generally, this can be prevented by slowly unrolling the film in a bath of carbon tetrachloride under precise laboratory controls and in an adequately ventilated area. In the third stage, only small portions of the film may be reproducible. When of sufficient value, such portions should be separated and copied; the original should then be destroyed. Film in the fourth and fifth stages is photographically worthless and should be destroyed at once without further consideration.

Ventilation Important When Inspecting

During the initial inspection of film storage facilities it is quite possible that a relatively high proportion of film in advanced stages of decomposition may be found. The opening of cans containing such film may liberate quantities of noxious and toxic gases into the working area. Personnel exposed to these gases often experience nausea, headache and other unpleasant symptoms if the ventilation is inadequate. Inspection personnel should therefore be given periodic rest periods in fresh air.



INVESTIGATIONS AT THE National Bureau of Standards have revealed that spontaneous ignition of decomposing nitrate film can occur; upper left photo shows a reel of film following such a test. Deteriorating cellulose nitrate film is classified into five stages of decomposition. In the first and second stages the film is photographically reproducible while in the third stage, upper right, only small portions may be reproducible. Film in the fourth and fifth stages of deterioration, lower left and right, is photographically worthless and should be destroyed immediately

When films in the third, fourth and fifth stages of decomposition are designated for disposal, they should be submerged immediately in water-filled drums, carried to a remote, uninhabited area approved by fire authorities, and destroyed by burning. The area or ground on which the film is to be burned should be free of brush, grass, leaves and combustible litter. Burning should be confined to batches of not more than 25 lb because the heat from larger amounts of film creates a strong updraft which may bear fragments of burning film considerable distances, thus endangering neighboring properties.

Under no circumstances should films be burned in an inhabited area or within a building. The rapid production of gases during burning makes it extremely dangerous, particularly if the film is burned in a furnace or confined space. During test fires in a well vented vault, engineers of the interagency advisory committee for nitrate film vault tests recorded pressures as high as 18 lb per sq. in. No ordinary furnace structure could withstand such pressure; its breeching would fail, thus filling the furnace room with flames and poisonous gases.

[For an earlier report on this work, see *Spontaneous Ignition of Decomposing Cellulose Nitrate Film*, by James W. Cummings, Alvin C. Hutton and Howard Silfin, Journal of the Society of Motion Picture and Television Engineers, Vol. 54, No. 3, March 1950, p. 268. For related information, see *How Humidity, Temperature Affect Motion Picture Film*, by Harry C. Brecha, Heating, Piping & Air Conditioning, September 1950, p. 106.]

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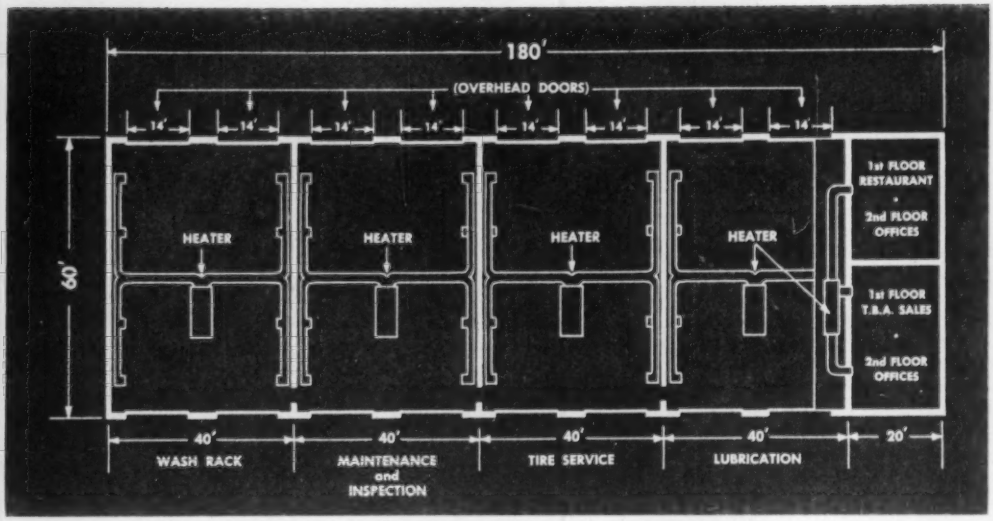
For the latest information on new and improved products, read the Equipment Developments columns in Heating, Piping & Air Conditioning each month.



Suspended Oil Fired Units Heat Truck Service Center

Motor Truck Services, Inc., recently opened a one-stop service center for trucks which presented a heating problem due partly to frequent opening of the large overhead doors. The problem was met by installing five suspended oil fired warm air heaters, which are supplied from two fuel oil tanks. The job is described here by L. J. Perron, Manager, Sales Engineering, Overhead Heaters, Inc.

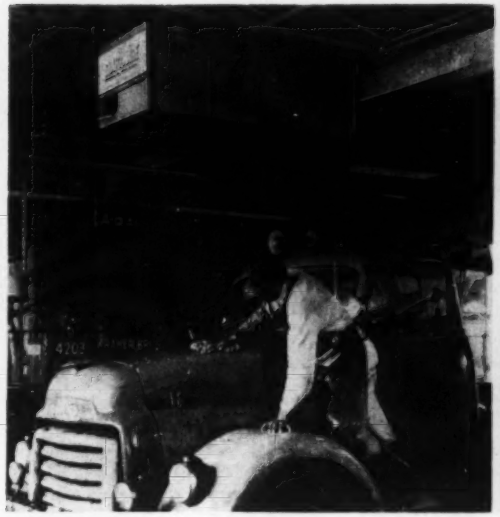
SUSPENDED OIL FIRED warm air heaters have proved to be the answer to a difficult heating problem in a large one-stop "super-service center" for trucks, recently opened by Motor Truck Services, Inc., Detroit. Departments in four connected single story buildings take care of all truck service except major repairs. In addition, there are offices, the sales department and a restaurant in the two story administration building.

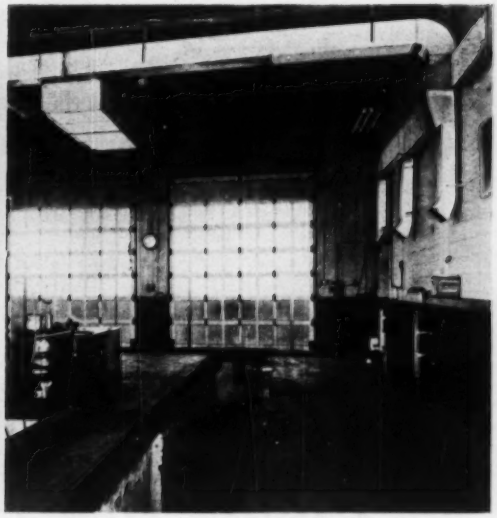
All service departments are designed for straight-through operations, with two 14 ft overhead doors at each end of each department. These overhead doors presented a major problem in design of the heating system. Since they are opened and closed repeatedly during the 24 hr operation, they represent a tremendous heat loss.

It was decided that the minimum temperature in the shop should be 65 F at 0 F outside, and that in the administration building 72 F at 0 F outside. A heating system with fast heat recovery, consistent with practical and economical operation, plus individual temperature control in each zone, seemed the answer.

Four oil fired heaters of approximately 300,000 Btu output each are used for the service departments, one to each building; a heater with an output of around 200,000 Btu serves the salesroom and restaurant downstairs and the offices upstairs in the administration building. Each unit is controlled by its own thermostat, thus giving individual control of temperatures in each zone. Vitreous lined stacks were installed on the units, and each is equipped with a cap to insure good draft and to prevent downdraft.

The duct work is more elaborate than is usually necessary in this type and size of building. The frequent opening of the overhead doors necessitated an extensive duct installation to blanket all working areas with heat. The ducts are dropped from the heating units, which are sus-





pended approximately 14 ft above the floor, to 8 ft above the floor, with four ducts along each wall. They cause a circular movement of warm air down to the floor from each side of the room and upward from the floor to the cold air return.

Two fuel oil storage tanks, equipped with high lift pumps, are used to supply the entire installation. Ordinarily, the two stage pump on the oil burner is sufficient to deliver a proper fuel supply to the burner, but the height of these units above the floor, the number of units to be supplied, and the long fuel line runs made it advisable to install the high lift pumps on each tank.

Rapid heat recovery is reported for the units by William V. Monahan, vice president and general manager of the truck service firm. No difficulty was experienced in maintaining a constant temperature of 75 F while drying out the building during construction last winter.

This installation is a good illustration of a difficult heating problem overcome by engineered individual zone controlled heating. Chyz Construction Co. was the general contractor, and the heating system was installed by Toridheet Engineers.

Supermarket Has Floor Panel for Check Stand Area

Duct Furnaces Supply Other Heating

To SOLVE A UNIQUE heating problem in the new King Cole supermarket in Whittier, a suburb of Los Angeles, nearly 1200 lineal feet of ½ in. copper coils on 12 in. centers under the 60 ft long check stand area are used in a floor panel radiant heating system installation. The coils are on 1½ in. of insulating concrete, and are covered with 2 in. concrete flooring poured over the grid.

Water is circulated from a gas fired booster heater. The water temperature is maintained at 100 F by an immersion thermostat in the return manifold.

The water is circulated through the coils and then back to a steel manifold into a pump and to the water heater. Each of the two sections of the radiant heating panel is broken into two coils to keep the friction loss at a minimum, making a total of four coils. Each coil is provided with a plug cock at the manifold for balancing the system.

No other area in the store is radiantly heated. Additional heating is provided by two duct type furnaces, each having an input of 200,000 Btu per hr. The registers are located at the two main entrances to the store; one at the store front, and the other leading to the rear parking area.

This installation is considered sufficient, as the mild Southern California winter climate does not impose too severe a heat loss on the building. Also, the lighting provides a good deal of heat. It was felt that the store customers, in winter clothing, would be sufficiently comfortable without additional heating, and the stockroom workers are of course very active.

Store ventilation is provided by seven evaporative cooling units with individually controlled circulating pumps. Five of these seven units have a capacity of 10,000 cfm each. The remaining two units have a capacity of 5000 cfm each, and are connected to the two duct type furnaces. These latter two units are provided with two-speed motors, the low speed for winter use. The furnace controls are energized through relays when the 5000 cfm evaporative cooling units are operating on low speed only.—LAWRENCE B. FREED, Consulting Engineer (as told to GIB CLARK).

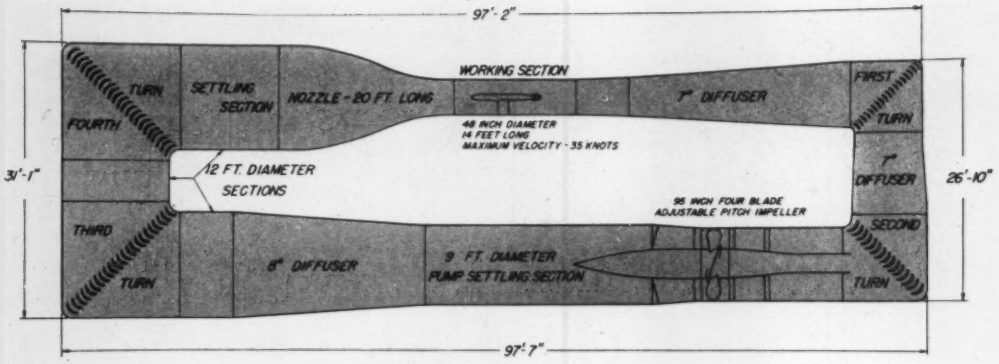


FIG. 1 — HYDRODYNAMIC CIRCUIT of the water tunnel, which is quite similar to a subsonic air (wind) tunnel

Piping Big Water Tunnel for Naval Research

By J. M. Robertson and R. L. Steele*

Ordnance Research Laboratory, School of Engineering

The Pennsylvania State College

The Garfield Thomas Water Tunnel is a research facility for studies in fluid mechanics and comprises a closed pipe circuit, a cooling system for maintaining the tunnel water temperature within desired limits, and water handling and conditioning equipment. The tunnel water is cooled by means of a 350 ton refrigeration compressor, a cooling tower, or both

THE GARFIELD THOMAS Water Tunnel is a research facility operated by the personnel of the Ordnance Research Laboratory, a unit of the School of Engineering of The Pennsylvania State College, under contract with the Bureau of Ordnance of the Navy Department. Personnel of the water tunnel are primarily concerned with research in fluid mechanics and are responsible for the operation of the tunnel and its auxiliary facilities.

A water tunnel is the hydrodynamic analogue of the better known aerodynamic wind tunnel. An air or water tunnel is used to study the flow around bodies by holding the body still and moving the fluid past it. The chief difference between a water tunnel and an air tunnel is that the test fluid is water rather than air and the pressure in the test region is one of the prime variables (in most air tunnels, the velocity is the only prime variable). The circuit of the water tunnel is shown in Fig. 1, and the similarity is apparent to anyone familiar with subsonic air tunnels. The Garfield Thomas tunnel, being nearly 100 ft long and 31 ft high, is the largest such hydrodynamic facility in the United States.

In order to study flow around underwater bodies — such as torpedoes, submarines and propellers — the velocity, pressure and temperature of the water must all be varied. The tunnel water velocity is continuously variable up to a speed of 80 fps, and the pressure in the working section is independently variable between 3 and 60 psia.

The pressure is independently variable so that operation at different depths may be simulated and the important underwater phenomenon of cavitation may be suitably scaled. The temperature of the water is also made a variable in order to permit an independent change in the Reynolds number — which is just as important in scaling or modeling water tests as it is in aerodynamic testing. As will be explained later in more detail, the range of water temperatures available in the tunnel is 40 to 120 F. The test or working section of the water tunnel is 4 ft in diameter and was designed to handle an 8 in. diameter model torpedo with propeller.

Water Tunnel Circuit Is Closed Loop

The circuit of the water tunnel is a closed loop of pipe containing a pump at one place and a test region in another location. As in a hot water heating system, the water just goes around and around and gets nowhere. The energy input from

*Mr. Steele is now with the E.I. du Pont de Nemours engineering department.

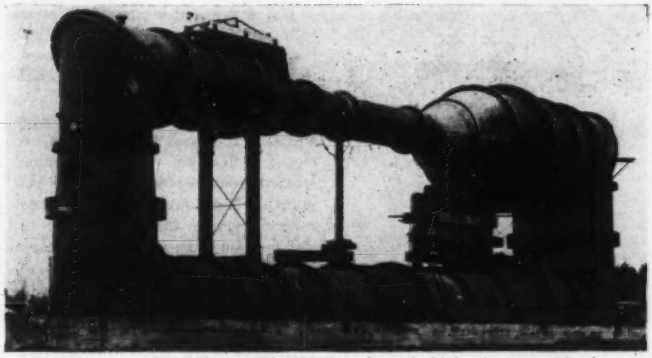


FIG. 2 — NEARLY 100 FT LONG and 31 ft high, the tunnel is the largest such hydrodynamic facility in the U.S. Photo was taken before final welding

the pump is therefore needed only to overcome the frictional losses in the system.

The cylindrical working section or test region is located in the upper leg and is 48 in. in diameter and 14 ft long. It is preceded by a 20 ft long nozzle which contracts from a 12 ft diameter upstream — a settling section. The purpose of the nozzle is to give a uniform flow in the test region. After the working section, the flow diffuses and passes through two turns before it reaches the 95 in. propeller type adjustable pitch pump.

The diameter of the pump is larger than that of the working section in order to obtain a high efficiency pump and to reduce its cavitation susceptibility. The diameters of all sections of the tunnel circuit are made larger than that of the working section in order to keep down circuit energy losses. The pump is followed by a section of straight pipe, a diffuser to the 12 ft diameter of the two following turns, and the settling section. All of the turns in the tunnel are of the miter type with included turning vanes. In general, some 20 airfoil type guide vanes are used in each turn. The circuit design of the tunnel is in general agreement with usual aerodynamic practice for air tunnels.

Except for the nozzle, working section and transition section (that gradually curved section between the working section and the start of the diffuser), the tunnel shell is made of mild steel plate with a thickness between 3/8 and 9/16 in. As may be noted from Fig. 2, the shell is stiffened at appropriate locations by flanges and is of welded construction. The pump section of the tunnel is broken up by bolted joints in order to permit access to the pump. The working section, transition section and two of the three sections of the nozzle are large bronze castings machined to close tolerances. In the nozzle and transition region, they have a thickness of about 2 in.

The details of the working section, Fig. 3, will not be described here except to state that there are 4 in. thick formed plexiglas windows to permit observation of tests. To prevent corrosion, all internal steel surfaces of the tunnel are coated with a vinyl plastic paint.

The rate of flow through the tunnel may be varied by changing the rotational speed of the driving motor attached to the pump shaft. This 2000 hp variable speed induction motor can be run at any speed between 0 and 180 rpm. The water speed may also be varied by adjusting the pitch of the four pump blades, which may be set at any angle between minus 6 deg and plus 22½ deg.

It should be noted that the power input of the pump to the tunnel water is used only in overcoming frictional loss resulting from the water flow; hence, this power does no useful work and results only in the heating of the water.

Tunnel Cooling System Maintains Temperature

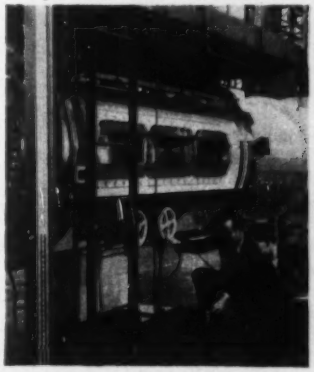
The tunnel cooling system is needed to compensate for the temperature rise of the water which — at maximum power input — is about 3 F per hr. If the tunnel is run for any length of time at this rate, appreciable temperature changes occur which are undesirable in such a research facility. Also, if only natural cooling were available, the temperature drop during shutdown periods would be of the order of 1/10 F per hr. The ratio of these two rates of temperature change indicates 30 hr of shutdown for each 1 hr of operation at full power — unless mechanical cooling is provided. The tunnel is not often run at full power, but artificial cooling is still a desirable feature.

The second reason for artificial control of tunnel temperature is that a variation of water temperature between the range of 40 to 120 F changes the water viscosity by a factor of two. This permits an independent variation of test Reynolds numbers by this same factor.

The cooling system permits maintenance of a temperature between 70 and 80 F in the tunnel under any load condition; at temperatures less than 70 F, the capacity is not great enough to compensate for the temperature rise under all load conditions. This is true since the tunnel water is cooled by a refrigeration machine sized to cool 70 F tunnel water. Operations at reduced temperature are therefore usually accompanied by a slow temperature rise. This is not considered to be a serious limitation to the tunnel as a test facility.

The tunnel cooling system is not automatic and requires manual adjustment of the various elements in order to set and maintain a given temperature. The tunnel contains some 106,000 gal of water and the metal portions weigh roughly 160

FIG. 3 — WORKING SECTION of the tunnel has 4 in. thick windows to permit observation of tests



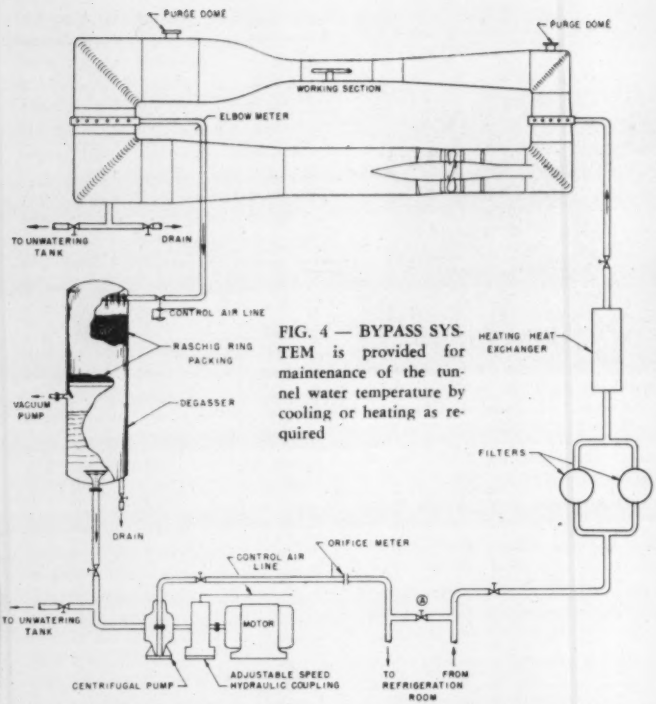


FIG. 4 — BYPASS SYSTEM is provided for maintenance of the tunnel water temperature by cooling or heating as required

tons. There is therefore a considerable mass involved and any temperature change is quite slow, so manual adjustment of the cooling rate is adequate. In many cases the tunnel is operated satisfactorily without any artificial cooling, as it is not often run at maximum speed.

The tunnel water is cooled with the aid of a bypass system which takes about 1000 gpm of water from the tunnel through a manifold at one point, passes it through various pieces of equipment (including heat exchangers) and returns it to the tunnel through a manifold at another location.

To prevent corrosion and to maintain tunnel water purity, all the piping in the bypass is nickel-clad 10 in. pipe of welded construction and all valves are bronze. The general arrangement of the bypass system for the tunnel is shown in Fig. 4. While the purpose of some of the items shown in this circuit will be discussed later, attention is called at this time to the lines leading to the refrigeration room where the cooling heat exchanger and the refrigeration machine are located, and to the heating heat exchanger.

The bypass flow through the heat exchangers and back to the tunnel is produced by the 1000 gpm centrifugal pump driven by a fluid coupling. The fluid coupling is used to vary the pump speed in order to correct for variations in the outflow rate from the tunnel and to aid the tunnel pressure control system.

The inter-relationships of the shell and tube type heat exchanger, cooling tower and 350 ton refrigeration machine are indicated in Fig. 5. Before describing the details of the operations of the various components, it should be noted that the water in the tunnel is of fairly high quality and hence is kept separate from the cooling water, which may be contaminated on passage through the cooling tower.

The cooling system for the tunnel water is so arranged that the water can be cooled either by using the cooling tower alone with the refrigeration machine off, or with the refrigeration machine and cooling tower both in operation. When it is desired only to prevent the tunnel water temperature from rising and when the outside temperature and humidity are sufficiently low, the heat may be dissipated without operation of the refrigeration machine.

The operation in this case is as follows: Bypass valves *A* and *AA*, Fig. 5, are closed and the warm tunnel water passes through the cooling heat exchanger and returns to the tunnel. To permit this, valves *B* and *C* are opened and *D* and *E* are closed. Cooling water is pumped from the cool water tank by the 900 gpm pump through the cooling heat exchanger and the warm water is dumped into the warm water tank. For this condition, valves *X*, *Y*, *B′* and *C′* are opened and *Z*, *D′* and *E′* are closed. The water in the warm water tank is cooled by pumping it to the cooling tower with the 1400 gpm centrifugal pump and from which it returns to the cool water tank.

All energy from the tunnel is of course ultimately dissipated by the cooling tower whether or not the 350 ton refrigeration machine is operated. This double flow induced draft tower will cool 1400 gpm of 95 F water to 85 F, at an ambient wet bulb temperature of 75 F. The 120 in. fan may be driven at 269 or 134 rpm, depending upon the rate of cooling needed.

When higher rates of cooling are desired, the 350 ton refrigeration machine, Fig. 6, is also employed. With this type of operation, valves *B*, *C*, *B′*, *C′* are closed, and the warm water from the tunnel passes through the evaporator by means of open valves *D* and *E*. The cooling water passes through the condenser through open valves *D′* and *E′*. Thus, the heat from the tunnel water is taken out at the evaporator and is given to the cooling water by the condenser. The heat in the cooling water is then again dissipated by the cooling tower.

The refrigeration machine is rated at 350 tons when cooling 1000 gpm of 70 F tunnel water using 900 gpm of 85 F cooling water. With this rating, the capacity of the refrigeration machine is not adequate to maintain temperatures appreciably below that of the ambient air temperature at the tunnel when it is operating under maximum power input. The refrigerant used is "Freon-11" and the machine is driven by a 300 hp wound rotor induction motor. Speed control is accomplished by adjustment of a resistance connected to the rotor; speed may be controlled in seven steps, over a range of about two to one.

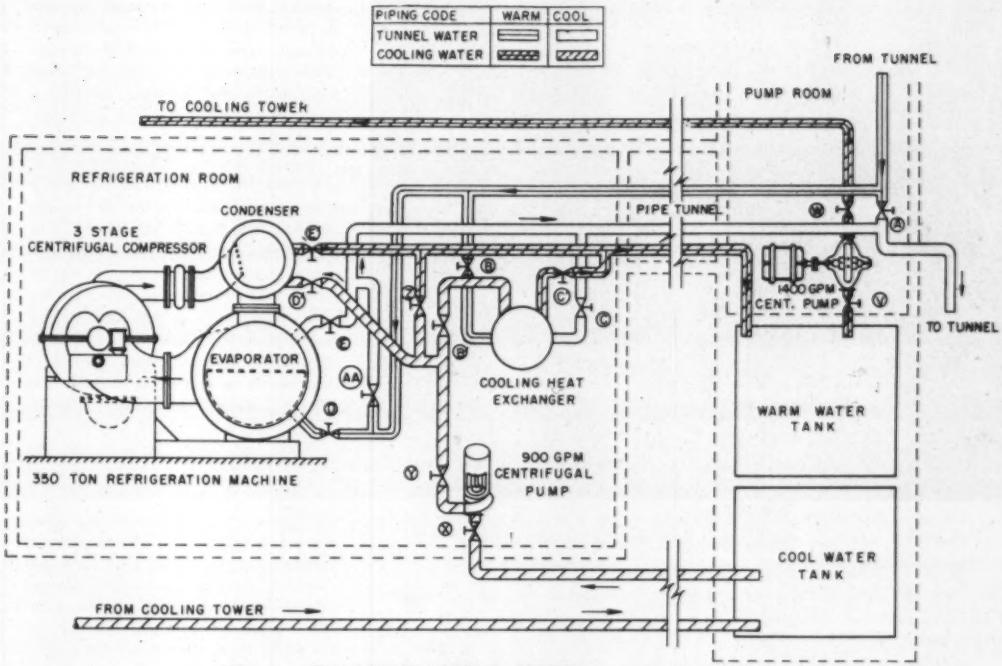


FIG. 5 — THE WATER TUNNEL COOLING system. Water may be cooled by cooling tower alone or by refrigeration machine and cooling tower, depending upon conditions

The refrigeration cycle, Fig. 7, is as follows: Refrigerant flows from the condenser to the flash chamber, the pressure of which is regulated by the second-stage pressure in the three-stage centrifugal compressor. By means of a float valve in the condenser, the refrigerant is throttled from the condenser pressure to the flash chamber pressure. The vapor formed when the refrigerant flashes in the flash chamber passes to the second stage of the compressor while the liquid is throttled to the evaporator pressure by means of a float valve located in the evaporator. In the evaporator, the refrigerant picks up heat from the tunnel water and flows to the compressor. An adjustable suction damper interposed between the condenser and evaporator permits some variation in the capacity of the machine. In the condenser, the cooling water, in taking the heat from the refrigerant, condenses it.

The capacity of the machine can be varied by two methods — the suction damper may be adjusted or the speed of the drive motor may be varied. The machine is of course equipped with suitable safety devices and an air purging system.

How Tunnel Water Is Heated

Heating the tunnel water is not so much of a problem as cooling it.

The water may be heated by operating the tunnel at full power, which results in a temperature rise of 3 F per hr. About 15 hr of operation is required to reach the maximum operating temperature of 120 F. To aid in heating the tunnel water, the bypass system contains a heating heat exchanger of the shell and tube type, shown in Fig. 4, which is supplied with steam at a pressure of 15 psia and produces a tunnel water temperature rise of a few degrees per hour. Joint operation of this heat exchanger with operation of the tunnel at full power input is the method currently used to get the maximum rate of heating.

The rates of tunnel heating and cooling mentioned above are essentially those used for the design of the cooling system. However, a recent check in which the tunnel water temperature was lowered to 40 F and then raised to 120 F has generally verified them.

Water Conditioning and Handling

The bypass system shown in Fig. 4 also includes several items used for conditioning the water. In a water tunnel used for studying cavitation, it is desirable to have control over the amount of dissolved gases. For this reason, the bypass system contains a cold water vacuum type degassifier, located near the point at which the water is taken from the tunnel. The upper portion of the 6 ft diameter, 25 ft high degasser is filled with Raschig rings. A vacuum of about 28 in. of mercury is maintained in this region and the water is sprayed into the top of the tank. From the bottom of the tank the water is led by a pipe into the 1000 gpm pump with the hydraulic coupling. Control of the water flow from the tunnel to the degasser is an intimate part of the pressure control system and is accomplished by a remote controlled double plunger valve. The rate of flow through this line is indicated by an elbow meter.

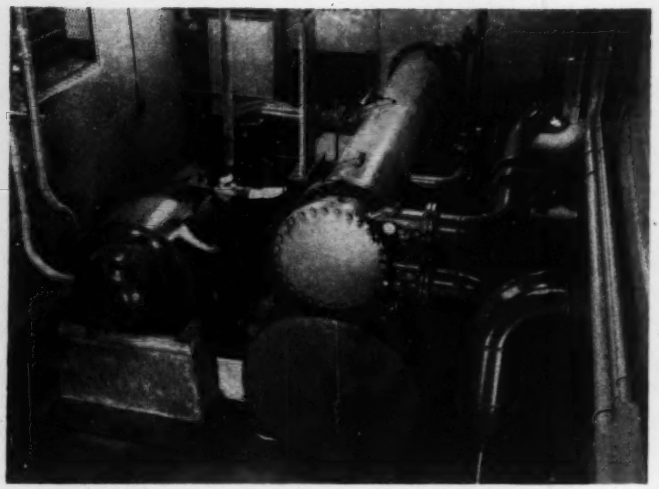


FIG. 6 — REFRIGERATION MACHINE, of 350 tons capacity, is sized to cool 70 F water. If mechanical cooling were not provided, tunnel water would increase, at maximum power input to pump, about 3 F per hr

The rate of water flow from the 1000 gpm pump is indicated by an orifice meter, as shown in Fig. 4.

The degasser removes all or nearly all of the dissolved gases from the water. It has been found that about 4 or 5 hr operation of this degasser in the bypass system will reduce the air content of the water from a saturated condition to a relatively low content. It is not always desirable to operate at extremely low gas content, so that consideration has been given to methods of reintroducing gas into the bypass line and to operating the tunnel without the degasser functioning.

A final item of tunnel water conditioning involves the purity. A relatively soft water of low dissolved solids content is used to fill the tunnel. As an added protection in case suspended material gets into the water, two parallel operating filters are installed in the bypass system. These have felt filter elements. Maintenance of the high purity of the tunnel water is desired in order to permit photographs to be taken of test objects.

The water tunnel is filled by pumping from the unwatering tank, indicated in Fig. 4, with the 1000 gpm pump. Actually, the volume of this tank is not adequate for the total 106,000 gal and it must be filled simultaneously from the supply line. As the tunnel approaches the full condition, the rate of pumping is reduced, and the trapped air is allowed to escape through 2 in. valves in the purge domes at the top of the tunnel. These domes, Fig. 4, are also used for freeing excess air (purging) during tunnel operations.

Access to test objects in the working section is obtained by one of two methods. With the first, the water in the upper leg of the tunnel is drained to the unwatering tank, and personnel are able to enter the working section through a removable hatch cover. It has been found possible to unwater this section, make minor changes, and refill in a 2 hr interval. For changes on torpedo or other models in the working section, a second method of access is available. With this one, no water is removed from the tunnel. All that needs to be done is to be certain that air is not permitted to enter the purge domes from outside the tunnel. The pressure control system is adjusted so that the pressure at the top of the working section is atmospheric. The hatch cover is removed, revealing a surface of water at atmospheric pressure. The model and associated equipment is raised up through this water surface by means of a hydraulic hoist. Achievement of this process is made possible with the aid of the well-designed pressure control system for the water tunnel.

Some of the features of the water handling and bypass system are determined by the fact that they are part of the pressure control system. Because of its considerable complexity and the fact that it is foreign to the primary purpose of this article, the pressure control system is not described herein.

The Water Tunnel is operated under Navy Contract NOrd 7958 and was built under Contract NOrd (F) 1445. Dr. R. B. Power was engineer in charge of engineering and construction for the Ordnance Research Laboratory.

The firm of Jackson and Moreland, of Boston, with W. D. Henderson as project manager, was responsible for the mechanical engineering and design features of the tunnel.

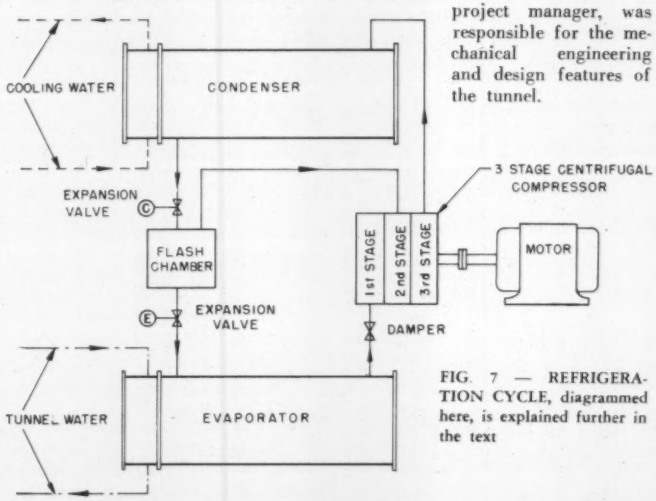
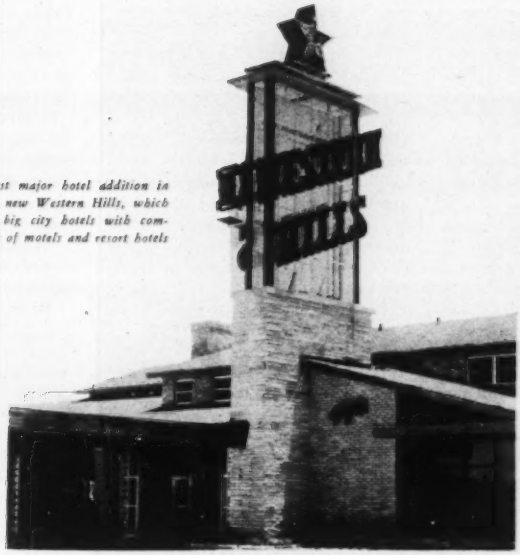


FIG. 7 — REFRIGERATION CYCLE, diagrammed here, is explained further in the text



FORT WORTH'S first major hotel addition in some 20 years is the new Western Hills, which combines features of big city hotels with comforts and conveniences of motels and resort hotels

Units Totaling 200 Tons Air Condition Western Hills Hotel

Small self-contained air conditioning units, most of them of 3 to 5 tons capacity, are employed with economy, practicality and flexibility to add comfort to the many other features of Forth Worth's new Western Hills hotel. A. W. Stubbeman, President, and H. B. Everett, Jr., Engineer, Almar-York Co., Inc., Consulting, Design & Contracting Engineers, describe briefly features of the installation

HAILED AS AN important "innovation in modern innkeeping", as a new and different type of hotel, and as a "dazzling example of the vast change which has taken place in the hotel business," Fort Worth's first major hotel addition in 20 years — Western Hills — represents, in our opinion, a notable advance in hotel air conditioning. The question that faced Western Hills' president and managing director, H. S. Green, was not whether to air condition the $2 million "wayfarer's rest" but how to air condition it completely, profitably and practically.

For here is a hotel comprised of a two story main building (topped by a penthouse) from which large one story wings extend like fingers. In addition there are 10 smart, colorful cabanas and 12 brightly designed guest houses in the latest contemporary idiom grouped about the hotel proper. There is a basement in one of the wings with attractive quarters for maids and chauffeurs, and a smaller basement section below the main building. The problem was to fully air condition all these areas.

A central station system would have necessitated a vast amount of duct work, and would not have taken care of the cottages and cabanas with the fine degree of practicality that was being sought. Surveys indicated that small packaged, sealed circuit air conditioning units, most of them of 3 to 5 tons capacity, would provide thorough air conditioning. This system was also viewed as achieving top economy, as it would preclude the necessity of air conditioning quarters not occupied or not in use for any extended periods.

46 Units Total 200 Tons Capacity

All of the air conditioning units — and there are 46 of them — develop the more than 200 tons capacity necessary for year 'round air conditioning of the 200 guest rooms, dining, club and other public rooms together with the kitchens and storage areas.

The units were selected because of their adaptability for heating systems

to which they are easily connected, thereby providing year 'round air conditioning — a growing practice today in the Southwest. Furthermore, all the types of units installed at Western Hills permit the use of automatic, two step capacity control, enabling the conditioner to adjust to reduced loads and effect power savings. Both are important factors to be considered in air conditioning hotels designed along the lines of the new Fort Worth hostelry.

The compact design of the units permitted their installation in out-of-the-way locations — basement areas, utility rooms and closets — to save space and reduce building costs. And the inherent flexibility of the units' design in the attachment of ducts and panels allowed "tailoring" of the job to available spaces and type of application.

Six 5 hp units under one common fan section condition the first floor of the main building, while two 5 hp units under one top section take care of the second floor. A 3 hp unit handles the third floor penthouse.

Each of the three wings is handled by three 5 hp conditioners, and another identical system provides cooling for the main dining room. The large public conference room, which is connected with the main building's first floor system, is also provided with two extra 1 hp models in case heat loads should become excessive. In the private dining room, a 1½ hp conditioner performs the same function.

The eight bedroom section in the basement is air conditioned by a 5 hp model. Western Hills is particularly proud of its facilities for maids and chauffeurs, as these are believed to be the first provisions made at any hotel in the Southwest for lodging servants traveling with hotel guests.

One 3 hp unit takes care of the beauty shop and barber shop, while two 1½ hp "twins" comfort cool the gift shop and liquor store.

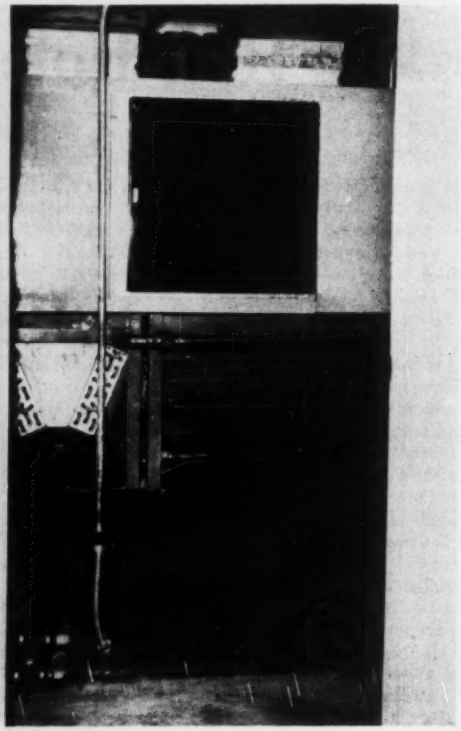
Outside the hotel proper, the cabanas are supplied by two 5 hp units, while another four 3 hp units (remote fan type) and eight self-contained 2 hp conditioners supply the cottages.

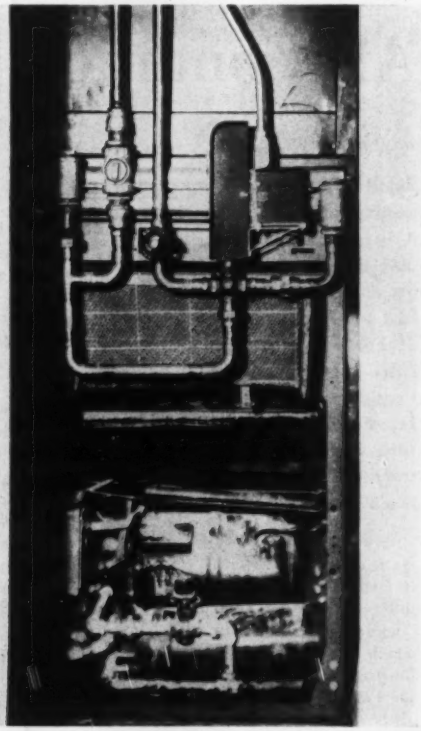
Heating is furnished throughout the main hotel and cabanas by staggered tube finned heating coils mounted in the conventional manner, with forced hot water circulation from one central boiler.

Heating of the cottages is by forced warm air systems built into the cooling systems.

High among Western Hills' "firsts" are the automatic ice makers. There are five of these freezing machines located in corridors of the hotel — within 100 ft of every room in the hotel proper. The guest may help himself, as each room, suite and cottage is furnished with an appropriate ice bowl. The hotel's other refrigeration requirements are taken care of by an ice machine and five condensing units ranging from 1½ hp to 2 hp for the numerous large food storage areas, all of which

TYPICAL AIR CONDITIONING unit (left) in one of the wings, comprising three 5 hp circuits under one fan section. Dark square is activated carbon odor adsorber cell with protective filter removed . . . . . THIS UNIT (right) is made up of two 3 hp circuits under one fan section, with water heating coil and three-way valve





were custom-built to the hotel's specifications.

Refrigerated Room Stores Garbage

Another modern feature at Western Hills is the freezing of garbage, a method found to insure utmost sanitation. Garbage is taken immediately from the kitchen to the service basement, where the wastes are frozen. A special walk-in refrigeration room has been designed for the storage of garbage until it is taken from the premises.

Four other large walk-in refrigeration rooms are provided in the basement for storage of large quantities of foods and beverages. One of these rooms is actually a "deep freezer". Temperatures of the others are maintained at constant levels best suited for the preservation of the specific type of food or drink stored in each.

Western Hills is unusual in that it was designed to contain the best features of large city hotels together with the last word in service, comfort and convenience provided by motels and resort hotels. Its kidney-shaped swimming pool, for example, is the only hotel pool in the Southwest equipped for water heating, and its use is free to guests. The heating load served by the hot water boiler was balanced out to take care of heating the swimming pool and rooms on a 50 deg day and therefore no additional heating capacity was required to heat the pool.

It is believed that the air conditioning installation affords ample evidence that the smaller, self-contained units can be employed with economy, practicality and with an almost limitless degree of flexibility for large installations where over 200 tons of air conditioning is required.

CABANAS AND GUEST COTTAGES supplement the accommodations in the main building. This is a view of the cabanas and the swimming pool from the air conditioned hotel terrace

NPA Interprets Construction Orders

AMONG AN EXTENSIVE list of interpretations of construction regulations issued last month by the National Production Authority were:

Type K tubing for underground water service connecting from the street to a house or building, may be used under section 7 of order M-4A. Weight of this copper tubing must be figured in computing specified quantities of copper under direction 1 of CMP regulation 6.

When a prime contractor has copper in inventory, or held for his account and will require no copper or other controlled materials for delivery after September 30, 1951, and wishes to use such copper for a purpose prohibited by section 7 of order M-4A, he must file an application on form 24-A and ask for an exception and the right to use his inventory copper prior to making use of his copper inventory for the prohibited purpose.

Section 7 of M-4A prevents a sheet metal contractor from fabricating on the job sheet aluminum in connection with an apartment house now under construction. Aluminum cannot be used in construction other than industrial construction without specific authorization from the National Production Authority. Section 7 of order M-4A does not prohibit the use of galvanized steel sheet in construction.

Where construction is necessary to sink a well for water supply to service a building, each such well or series of wells is a construction project separate from the construction of the building, and the prime contractor building the well may self-authorize the procurement of controlled materials for such well and its casing on the basis of 2 tons of steel and 200 lb of copper per quarter per project. The quota of controlled materials for such well is not charged against the quota of steel in the building.

Where an oil supply tank is connected to an oil burner by copper tubing and such tubing is installed by and is to be used by the owner of a building, the weight of such copper tubing is included within the quota which may be self-authorized under direction 1 to CMP regulation 6 for the building. However, if the tubing is installed by a utility and title to it remains in the utility, then such quota should not be charged against the owner of the building. This interpretation applies to all types of construction including residential.

London Zoo Installs HPHW Central Heating System

Heating has been a problem at the gardens of the Zoological Society of London since they were first opened to the public in 1828. Slow growth of the facilities over more than a century posed many heating difficulties, which are being solved by installation of a central (or, as it is called in England, a district) high pressure hot water heating system. The new method is described here by W. F. Moore

CERTAINLY NOT THE least of the many difficult problems which the Zoological Society of London has had to face since its gardens in Regent's Park were opened to the public in 1828 has been the maintenance of healthy thermal environments for many different species of living creatures.

Twenty-nine hand fired solid fuel boilers — many of them quite old — have been used to warm the various animal houses. Central stocks of coke, coal and anthracite have had to be built up each year during the summer. Throughout the winter, local fuel dumps placed near to groups of boiler houses have had to be fed continuously. Such a system is obviously uneconomic both in fuel and labor, and is also unsatisfactory in other respects. Serious disturbances are caused by breakdowns with no reserve boilers, and the difficulty of raising heat quickly in the English spring and autumn, when sudden temperature drops are often experienced, has been potentially dangerous to some of the animals.

Plans to rectify this state of affairs have been under consideration for a long time. The broad scheme is to link all the separate heating plants to one large high pressure hot water central plant.

12 Million Btu Heating Load

The total heat loads have been estimated at 5 million Btu per hr in summer and 12 million Btu in winter. Certain houses, such as the reptile house and the aquarium, have received special attention because an unfailing supply of heat is particularly vital to the safety of the animals. Of the total winter load, 8 million Btu is essential in this respect. The new central plant, therefore, consists of two boilers, either of which can handle the essential load on its own. As a further precaution, the "essential" houses retain their hand fired boilers for standby.

A HEALTHY thermal environment for many different species of living creatures is an important zoo problem (Copyright photo courtesy Zoological Society of London)

The new boilers are of the forced and controlled circulating type, each with a maximum capacity of 9 million Btu per hr at 120 psi working pressure. Each is fitted with a set of low pressure air oil burning equipment, suitable for firing semi-automatically either heavy fuel oil or creosote pitch. Photo-electric flame failure devices operate through magnetic valves on the oil lines.

The oil storage totals 19,100 gal, contained in two 16 ft x 8 ft x 12 ft high sectional steel tanks, with 3 in. vent and filler connections together with distant indicators.

There is comprehensive instrumentation in the boiler house, including continuous CO_2 recording. Provision is made for a high pressure air line from the aquarium compressor to the new boiler house for soot cleaning purposes.

Flow and return steel pipe mains, butt welded throughout, will carry the high pressure hot water through insulated concrete ducts to the various buildings, with isolating valves at suitable locations in the mains system so that in the event of repairs to mains or modifications it will be unnecessary to close down the entire system. Expansion pockets are provided every 150 ft with intermediate anchor points throughout the mains. To minimize mains losses, a mixing valve will reduce the temperature of circulated water during warm weather; this valve is proportionately varied by the outside air temperature. Heat exchangers for domestic services in use during the summer are sized for this reduced temperature in the mains.

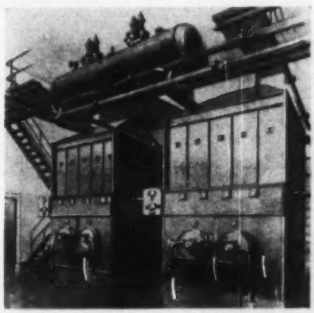
In general, the present individual heating systems — most of them low

pressure hot water — will be retained and connected to welded mild steel heat exchangers. But many special local problems have had to be solved. For instance, in the reptile house, in which the imitation rocks have to be heated, it is planned to retain the electric tubular heaters in the concrete "rocks" — to do otherwise would entail remaking them — and to use HPHW radiant panels to replace the electric heaters now used for general heating. The aquarium and chimpanzee houses are at present steam heated; here, a low pressure steam generator taking heat from the HPHW mains will be employed, with one boiler remaining as a standby. The steam generator for the aquarium is connected by separate mains to its own main circulating system, so that it is not affected by the mixing valve referred to earlier. In the gorilla house, which has a plenum system, the electric heater battery is being replaced by a HPHW heater battery.

Stacks Concealed in Terraces

As the zoo premises are situated in a park, it was decided that the 60 ft high stacks must be hidden from view and constructed into the existing imitation rockwork of the Mappin terraces. This defined the site of the boiler house. The flue gases from each boiler are conveyed to 36 in. diameter asbestos-cement flues supported on steel framework and encased in the Mappin terraces.

The work is being carried out under the general direction of F. A. Stengelhofen and S. Matthews, of the architects' department of the Zoological Society. The engineers are Matthew Hall & Co., Ltd.



THE TWO HIGH PRESSURE hot water boilers for the London zoo are shown in this artist's impression

RADIANT HEATING WITH WOOD FLOORS

WITH REFERENCE TO the letter from "L.C.W." on radiant heating with wood floors, published in the July issue, he may be interested to learn of our experience.

While our climatic conditions are considerably more severe than those in Australia, we are much more liberal in the matter of permissible heat release rates from floors. We encounter outside design air temperatures above 0 F only in one province of the Dominion—British Columbia. At the same time we become concerned about the rate of heat release from floors only when this exceeds approximately 65 Btu per sq ft of floor. This figure covers only that portion of the heat which flows upward into the room.

We feel, on the basis of experience, that this figure is conservative, and it is applied only to residences or to floors of rooms which are continually occupied. Industrial installations and garages with unfinished floors are treated differently, as the release rates may, in these cases, run as high as 90 or 100 Btu. There are a few of these buildings where the release rate is even higher.

These heat rates were established not by actual measurement but by dividing calculated heat losses of the structures concerned by their respective floor areas. The heat losses are estimated by accepted ASHVE Guide methods of calculating conduction and infiltration losses as is done for conventional heating.

When wood floors are favored by potential users of radiant heating, we consistently suggest one of two alternatives; the wood finish should either be parquet (which intimately contacts the slab surface through the bond provided by the mastic adhesive), or the entire undersurface of the floor must contact the top surface of the slab. This means, in the case of conventional wood floors, that nailing strips must be set into the concrete and flush with the surface. We also specify a slow initial start-up of such jobs to avoid the possibility of drying out the wood too rapidly.

We would never recommend the type of floor construction used by "L.C.W.," because in that type of arrangement there will be hot strips over the floor surface. These strips will not affect comfort, but, in our opinion, the uneven temperature across the floor surface might cause warping of the wood. The air space also offers a barrier to the flow of heat, so that the heat emission of the floor is much less than it would be if the under side of the floor contacted the heated slab intimately.

Because of this different approach, it is likely that we would not have done the job as "L.C.W." did it. We are inclined to think that our design would have depended 100 percent on floor heating.

Because of the experience in this country, we would be most particular about control — a positive immediate shutoff of heat delivery to the slab when the desired air temperature has been obtained. It is possible to have too high a floor temperature, but this is almost always the result of continuing heat delivery to a slab after the desired air temperature has been reached. This can happen through control failure or because an installation is called upon for too rapid a pickup. Such conditions in our experience are very rare, and we have not yet found any installation where the floor temperature exceeded comfort limits, when controls were functioning correctly.

"L.C.W." asks for information on balancing. The first step is to establish a uniform temperature in all returns, by throttling the warmer valves. Thermometers installed in wells are of considerable assistance at this stage, although in the event of their absence, a surface pyrometer is very useful. When all returns have reached the same temperature, balancing can be completed by trimming to room air temperatures, after which stage the job is treated as a conventional water system — if one room requires more heat, open up its return valve. If the valve is already wide open, throttle all the other return valves until the room comes up to the desired temperature.

If an attempt is made to balance to room air temperatures before evening up return temperatures, the results may be confusing. We have seen many cases where short coils have robbed longer ones, without, at the same time, disclosing that fact by elevating the air temperature in the room served by the short coil.— W. A. CONNOR, Service Engineer, Radiant Heating Div., Page-Hersey Tubes, Ltd., Toronto.

Ventilation and Air Conditioning at Florida Power's Higgins Plant

Ventilation of the boiler room, turbine room and switchgear bay, and air conditioning of the centralized control room of a new power plant, is described in this brief article prepared by the heating, air conditioning and ventilating section of The Kuljian Corp., engineers and constructors

VENTILATION DESIGN for the boiler room and turbine room of the Florida Power Corp.'s new Higgins plant at Booth Point was based on approximately 12 air changes per hour, or one change in 5 minutes. In the boiler room, the forced draft fans handle a total of 124,000 cfm, which provides approximately a 3 minute air change from the ground floor to the forced draft fan floor level 79 ft, 4 in. above it. Since this area is at a relatively high temperature — being adjacent to the boiler — an increase in the ventilation rate from a 5 minute to a 3 minute air change was decided upon.

It was deemed desirable to locate the outdoor air intake louvers near the ground floor and operating floor levels to obtain maximum travel and distribution of the air before it is discharged by the forced draft fans to the steam generating unit. This arrangement left the area above the forced draft fans to the roof without ventilation, so 60,000 cfm or 4.8 minute air change is provided above the fan floor level by means of three power roof ventilators. These roof ventilators also receive air supplied through the same outdoor air intake louvers at the ground and operating floor levels, thereby providing for maximum air travel. This gives a total ventilating capacity for the boiler room area of 184,000 cfm.

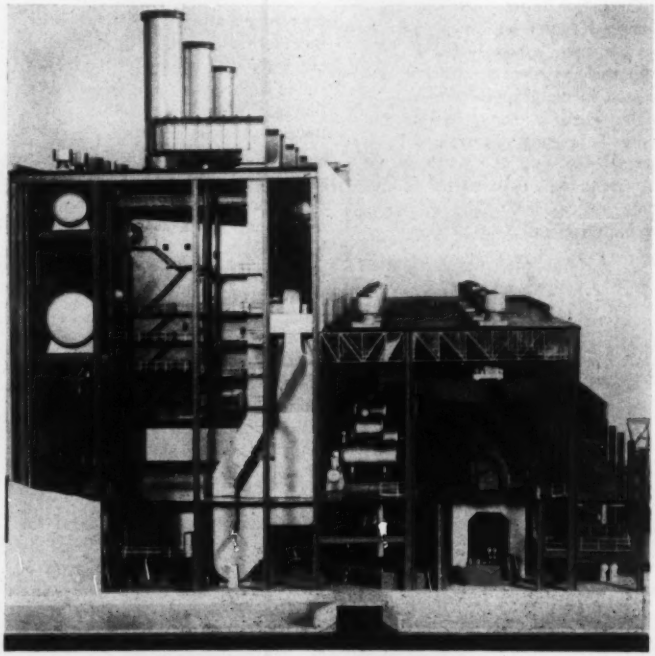
Since the east side of the building is for the future addition of the second and third units of the plant, it was advisable to locate the outdoor air intake louvers for the boiler room area on the south side and as low as possible. It was necessary to place the louvers above the roof of the one story storage area, which is in that location. These louvers are in two tiers, one above the operating floor level and the other just below operating floor level, and each furnishes ventilation to its respective level. Each tier has 320 sq ft of gross area (160 sq ft free area) and is capable of handling 92,000 cfm at 580 fpm velocity, or a total of 184,000 cfm. A 580 fpm velocity through such intakes is conservative, but it was believed that the louver area should be oversized to provide for any future desired increase in ventilation without requiring more louver area.

The louvers are of the manually operated type from fully open to fully closed and are furnished with insect and bird screens fastened to the outside frame.

Ventilating the Turbine Room Area

In the turbine room area, a total of 130,200 cfm is exhausted through four power roof ventilators, each handling 32,550 cfm and providing approximately a 5 minute air change for the entire area. These ventilators are above the turbine room on the roof.

Intake louvers for air supply to the roof ventilators are located and



sized to provide suitable distribution and ventilation to the various levels and areas. The louvers in the north wall are located as follows:

a) The ground floor level has an air intake louver 198 sq ft in gross area, capable of handling 49,000 cfm at 495 fpm velocity, giving the ground floor level area a 4.2 minute air change.

b) The switchgear area, with an elevation 26 ft above the ground floor, has an air intake louver 40 sq ft in gross area, capable of handling 4200 cfm at 210 fpm velocity, giving the switchgear area a 5.5 minute air change.

c) The operating floor area above the switchgear area is provided with an air intake louver of 320 sq ft gross area, capable of handling 77,000 cfm at 480 fpm velocity, giving the turbine room operating floor area a 5 minute air change. These louvers are above the roof of the switchgear area.

All louvers for outdoor air to the turbine room area are located to give maximum air travel before the air reaches the roof ventilators, and have been sized generously to provide any increase in ventilation in the future.

These louvers are also of the manually operated type, from fully open to fully closed, and are provided with bird and insect screens fastened to the outside louver frame.

Summarizing, the ventilation for these areas is:

Boiler area
850,000 cu ft content
184,000 cfm
4.6 min air change
Turbo-generator area
661,000 cu ft content
130,200 cfm
5.0 min air change
Total
1,511,000 cu ft content
314,200 cfm
4.8 min air change

Heat Pumps for Office, Control Room

The office area and control room are air conditioned both winter and summer, using three packaged heat pump units. One 5 ton unit handles both the private office and the general office. A 7½ ton unit conditions the reception room, laboratory and lunchroom. Both these units distribute either warmed or cooled air through ducts concealed above a suspended ceiling to aspirating outlets, which are located to throw the greatest volume of air over the office windows on the west sides of these rooms.

Outdoor air is supplied to the heat pump units by intake stacks through the roof. Air is returned to the units, for recirculation with the outdoor air, by means of louvers in the interconnecting doors and return grilles at the units. Air is also exhausted from the office area by roof ventilators which pull the air through the toilet rooms.

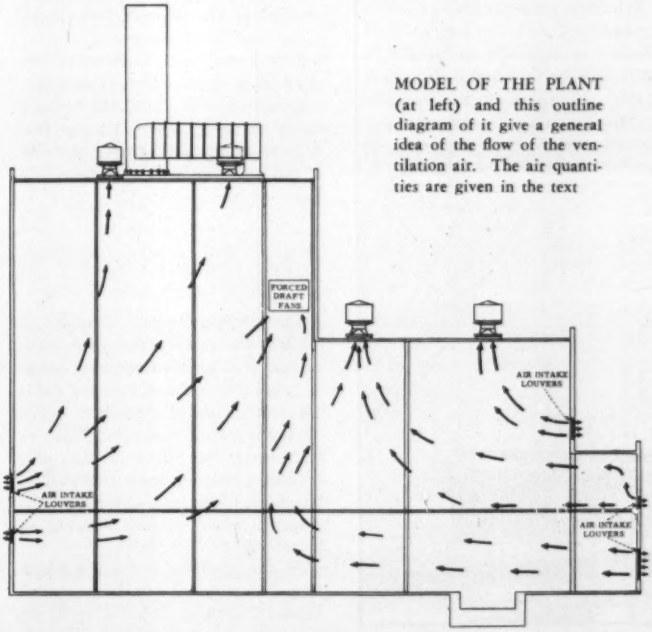
Ventilation of the adjacent areas of the mechanical shop and the plant employees' locker room is obtained through operating sash and individually controlled power roof ventilators.

On the operating floor level, the enclosed centralized control room is conditioned by a 5 ton heat pump unit. This packaged unit sits outside of the conditioned area with supply ducts running above a suspended ceiling and terminating in aspirating air outlets. The "outdoor" air for this unit is not taken from outside the building but rather from the large volume turbine room area in which it stands.

Future expansion of the centralized control room is provided for in the design and capacity of this system.

The water used as the heat transfer medium of these three heat pump units is circulated through a heat exchanger coil submerged in the intake tunnel below the ground floor.

The Higgins plant utilizes the unit system, consisting of a single boiler feeding a single turbine. The initial installation comprises a 450,000 lb per hr boiler and a 40,000 kw turbo-generator. The two future units will each have the same rating.



MODEL OF THE PLANT (at left) and this outline diagram of it give a general idea of the flow of the ventilation air. The air quantities are given in the text

INSTRUMENTATION MEANS BETTER PRODUCTS

CONTROLLABILITY BY instruments permits more latitude in the design of process equipment, which leads eventually to economies in the building of manufacturing equipment, and will therefore raise the quality and lower the cost of the product of the equipment, according to G.M. Muschamp, chief engineer of the Brown Instruments Div. of Minneapolis-Honeywell Regulator Co.

"For example," he said, "non-uniform heating used to trouble the meat packing industry, resulting in undercuring in the top part of the smoke house and over-curing in the lower part. This required an extension of the curing schedules to allow for lower temperature and smoke density at the top of the house. New ideas in smokehouse design, involving forced air circulation, air conditioning, insulation and instrumentation to maintain temperatures at pinpoint accuracy have brought economies and a better product to meat packers."

Supporting a Horizontal Tank

Hrant H. Yousoufian Analyzes Problem of How to Support Horizontal Tank of 10 Ft, 10 In. Diameter and 50 Ft Long

The author is in charge of testing and adjusting for the New York regional office of Buensod-Stacey, Inc., engineering contractors. The problem of supporting a horizontal tank, as discussed by Theodore E. Bridge in the June HPAC, is of particular interest to him, as his professional degree is in aeronautical engineering, and the aeronautical engineer is frequently concerned with determining the stability of thin walled structures. The problem is analogous to support of large thin wall pipe

• *Statement of a problem: It is required to support horizontally by means of concrete supports a tank 10 ft, 10 in. in diameter, 50 ft, 0 in. long, with dished heads, and fabricated of ¼ in. A-285 steel plate. The tank will be filled with water and will have an operating pressure of 25 psig.*

THE SOLUTION OF this problem falls within the realm of structural stability, a most interesting phase of stress analysis. S. Timoshenko is the author of a comprehensive volume, *Theory of Elastic Stability* (McGraw-Hill, 1936, 1st edition), in which he devotes two chapters to the fundamental theory governing the behavior of shells subjected to various types of loads. Many of the equations presented below appear in this book, to which the reader is referred in order to obtain a more complete understanding of the equations used here.

It may be stated beforehand that the effects of the maximum hydraulic stress (at the bottom of the tank) and those due to the 25 psi operating pressure as well as the maximum shear stress (at the supports) may be neglected in this problem.

Timoshenko gives the critical buckling stress of a (curved) shell subjected to a compressive stress as

$$S = E\ t/R[3(1-n^2)]^{\frac{1}{2}} \quad \ldots\ldots[1a]$$

where E is Young's modulus, psi; t is the shell thickness, in.; R is the radius of curvature, in.; and n is Poisson's ratio, which is 0.3 for steel.

Substituting $n = 0.3$ in Equation 1a,

$$S = 0.6\ E\ (t/R)\ .\ (\text{approx.})\ .[1b]$$

Extensive experimental work has demonstrated that the numerical coefficient in Equation 1b should be taken between 0.15 and 0.35, instead of 0.6 — the value which is indicated by theory alone. Selecting the conservative value, the equation is altered to

$$S = 0.15\ E\ (t/R) \quad \ldots\ldots\ldots[1c]$$

The above equations are valid if the yield point stress is not exceeded and if the following inequality is satisfied:

$$1.72\ (R/t)^{\frac{1}{2}} \text{ is greater than } 1 \quad ..[2]$$

The inequality of Equation 2 is satisfied in the numerical problems below and the compressive stresses will be found to be well below the yield point stress. If the inequality were not satisfied, it would be necessary to apply Euler's column formula to an elemental strip 1 in. wide at the point of highest stress. The Euler equation in modified form is

$$S = [\pi^2\ E\ (t/L)^2]/12(1-n^2)\ .[3a]$$

or

$$S = 0.9\ E\ (t/L)^2\ .\ (\text{approx.})\ .[3b]$$

where L is the length between supports, in.

The reader's attention is called to the fact that an elemental strip (such as part of a cylindrical shell) which is subjected to a compressive stress experiences lateral expansion and is obviously influenced by the adjoining segments. The effect of this phenomenon upon Young's modulus, E, has been taken into account by the presence of Poisson's ratio, n, in Equations 1 and 3 above.

In the problem under consideration, it is required that the maximum bending moment imposed upon the

TABLE 1

Method	Number of supports	Location	M_{max}	Location S_{max}
1	2	Each end	$W\ T^2/8$	$T/2$ — top
2	2	$T/4$ from ends	$W\ T^2/32$	At supports — bottom
3	3	Each end and center	$W\ T^2/32$	$T/2$ — bottom

T is the length of tank, in.

tank will not cause the resulting maximum stress to exceed the value given by Equation 1c.

Since

$$S = M\ c/I \quad \ldots\ldots\ldots\ldots\ldots\ldots [4]$$

for a beam subjected to a bending moment, we may equate [4] to [1c] and, solving for M, obtain

$$M = 0.15\ E\ (t/R)\ (I/c) \quad \ldots\ldots [5]$$

where M is bending moment, in.-lb; c is distance from neutral axis to most highly stressed fiber, in.; and I is moment of inertia about neutral axis, in.^{4}

For a cylindrical tank, the section modulus, (I/c), is $\pi D^2 t/4$ and $D = 2\ R$, so that Equation 5 may be restated as

$$M = 0.075\ E\ \pi\ D\ t^2 \quad \ldots\ldots\ldots [6]$$

For our problem, $E = 30 \times 10^6$ psi (steel), $D = 130$ in. and $t = 0.25$ in., so that $M = 0.075 \times 30 \times 10^6 \times 3.14 \times 130 \times (0.25)^2 = 57.4 \times 10^6$ in.-lb, the maximum allowable bending moment.

Let us now assume several methods of support and investigate the feasibility and economy of each one, as indicated in Table 1.

W, the beam loading in lb/in., consists of the weight of the full tank of water and the weight of the tank, which was shown* to be 6100 lb/ft or 508 lb/in. The length of the tank T is 600 in., so that the resulting maximum bending moments are:

Method 1:

$M = 508 \times (600)^2/8 = 22.9 \times 10^6$ in-lb

Methods 2 and 3:

$M = 508 \times (600)^2/32 = 5.72 \times 10^6$ in-lb

It is evident that the three proposed methods in Table 1 of mounting the tank will give a maximum bending moment which is less than the allowable. Since Methods 2 and 3 give the smaller value for the actual bending moment, only these two will be given consideration in the interest of safety.

Mr. Bridge* indicated that bracing the tank at the support must be considered if a local failure at the support is to be precluded. It is known that a thin walled cylinder subjected to pure bending will buckle at the point of maximum compressive stress involving an *inward* bulge. Now it is interesting to note that the maximum compressive stress occurs at the *bottom* of the cylindrical tank and *over the supports*. Since the theoretical analysis indicated by the foregoing observations is quite involved, the problem of providing bracing at the supports may be solved on a rational basis by following the recommendations of the California Corrugated Culvert Co., as described by Mr. Bridge in his article.

If Method 2 is selected, two 8 x 6 x 5/8 in. stiffening angles should be welded around the circumference of the tank above each supporting saddle. In addition, a 1/2 in. plate 18 in. wide should be welded to the underside of the tank and should extend around the bottom half of the tank on either side of the saddle.

If Method 3 is preferred, the above described scheme of stiffening at the center support should be followed. The application of only one 8 x 6 x 5/8 in. angle at each end support, without using a 1/2 in. plate, would be adequate.

Equation 6 was applied to the 6 ft, 0 in. pipe cited by Mr. Bridge in his article, and it was found to indicate a maximum allowable bending moment which is approximately 2 1/2 times the bending moment indicated by applying the formula $M = W\ T^2/10$. In the present problem, the indicated bending moment is only 1/10th the allowable, thus affording an even greater degree of safety in that respect.

*How Can I Figure Supports for a Horizontal Tank?, by Theodore E. Bridge, HPAC, June 1951.

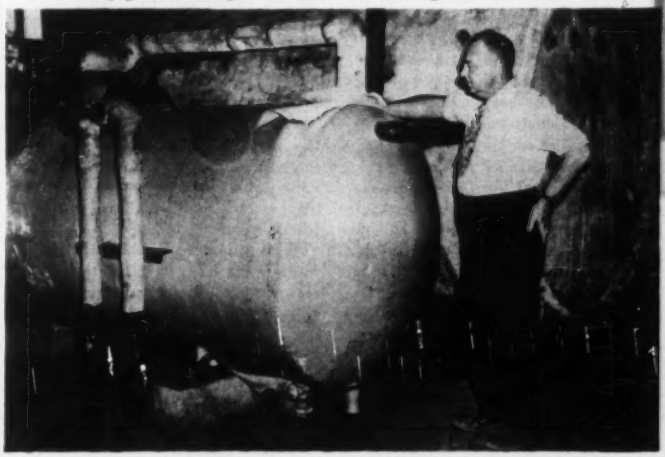
INSULATION AFTER A FLOOD

THE ARTICLE BY Samuel R. Lewis on rehabilitation of mechanical and other equipment after flooding, in the August issue, was most timely.

We were struck, however, by a statement regarding insulation, where the author referred to the matting of insulation and its dependence upon the cellular quality. No doubt the author did not mean to imply that this pertained to all types of insulation.

The accompanying photograph of the basement of the Winnipeg municipal hospital power house, Winnipeg, Canada, taken after the disastrous floods there, shows the 85 percent magnesia insulation on the steam lines and tank still in good condition. As Mr. Lewis pointed out, the jackets may need repairing but many instances of floods, sunken vessels and other lengthy submersions have proved that slow drying will put 85 percent magnesia back in satisfactory service under such conditions.—MARSHALL F. ALLEN, Manager, the Magnesia Insulation Manufacturers Association.

85 PERCENT MAGNESIA INSULATION on steam lines and tanks at Winnipeg was still in good condition after flooding



Solving Tricky Problem in Control of Air Supply Units

By Robert M. Lantry
Ventilation Engineer

Solution of this problem in industrial plant ventilation perhaps seems simple . . . . . but that did not appear to be the case when the author first confronted it. It often is true — as it was in this situation — that the seemingly small details are what make the big jobs tick

OUR PLANT POLICY is to catch heat, dust and fumes at their sources by means of carefully designed hoods, before they escape into the general atmosphere.

In a particularly bad area where a large volume of air is exhausted to dust collectors and discharged outside the building, we bring in outside air through contact type air washers to roughly balance the volume of air discharged by the exhaust. This volume of make-up air varies according to the room dimensions and the operations involved. For instance, in the heater rooms we exhaust 25 percent more than we make up, and in dust areas we exhaust 35 percent more than we make up.

Outside air make-up is brought in through the air washers, and through a system of ducts and air outlets we direct the air over the operators' stations to give them clean air to work in while the heat, dust or fumes are carried away from the operation that they are performing. This make-up air, being tempered automatically, prevents drafts as well as heavy fogs in our heater rooms in winter.

By means of a pump recirculating water over 20 in. by 20 in. glass fiber air washer cells 8 in. thick, we cool the air from 95 F dry bulb to 75 F wet bulb and deliver this clean, cool air to the operators' stations. The temperatures given are the summer averages for this part of the country.

Usual practice calls for using face and bypass dampers, which not only are expensive but are bulky. Factory floor space is also expensive, so we standardized on 14,000 cfm make-up air units and we suspend them from the factory ceiling.

The first winter of operation brought on a regular epidemic of frozen coils and ice formation covering our air washer filter cells.

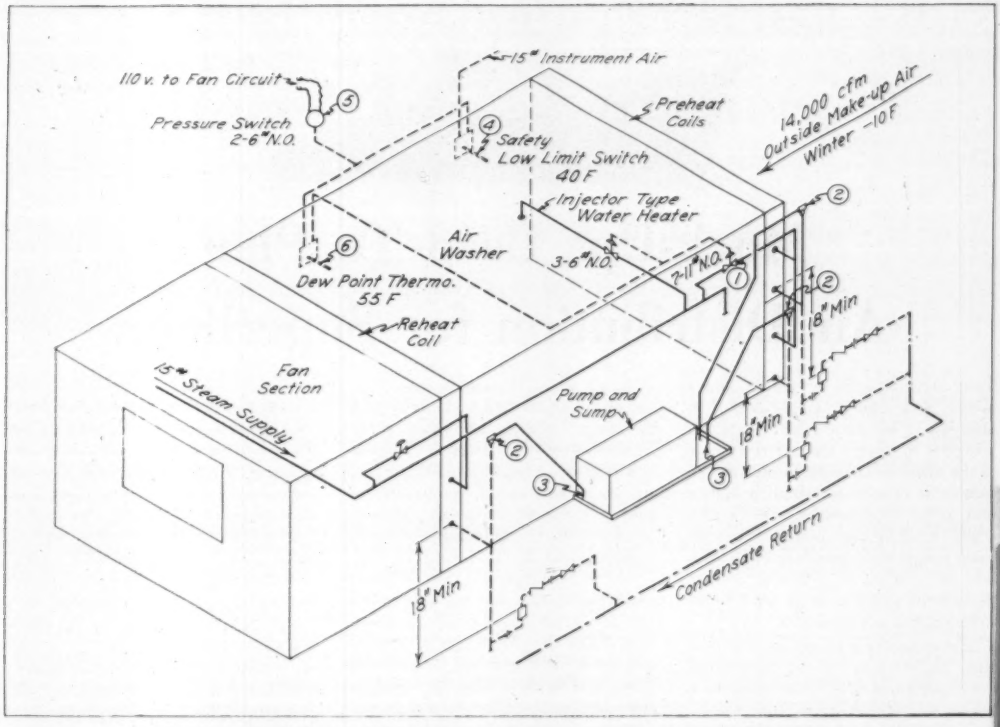
The pneumatic controls shut off the pump which circulates water over the air washer cells at an outside temperature of 30 F, and by means of a timer it comes on one minute out of 15 minutes to flush the dirt out of the cells. These controls are not shown in the accompanying diagram because this would confuse the sketch, but this condition presented the major part of our problem. Shutting down this pump at 30 F outdoor temperature saved a lot of steam.

With this pump in operation for one minute at —10 F winter design temperature, Item 6 on the sketch is a dew point thermostat that is calling for 95 F dry bulb off the face of the preheat coil. When the minute is up, the pump stops and 55 F (under the washer cells) becomes a dry bulb reading and is satisfied with 55 F dry bulb off the face of the preheat coil. This condition, of course, closes the automatic steam valve, Item 1, which, for a minute or two, lets —10 F air come through the preheat coil, condensing the steam in the coil and producing a vacuum in the coil as the trapped steam condenses to water.

With the steam shut off, the condensate bucket traps could not dump the water out of the coils, especially with a vacuum on the coil. Thus, the — 10 F air froze the coils and put a sheet of ice over the air washer cells.

To take the lag out of the process from 55 F wet bulb to 55 F dry bulb, which amounted to three minutes and 45 seconds, we placed a safety low limit thermostat, Item 4 on the sketch, in series with the dew point thermostat, Item 6, at the end of the preheat coil tubes to allow for coil temperature stratification. This idea worked and prevented ice formation on the cells by having 40 F air coming through the coil at all times. Item 4 called for steam before Item 6, reducing the lag to 20 seconds, and when Item 6 called for steam, it satisfied Item 4, and it, in turn, passed 15 lb instrument main air on to Item 6 to take over the cycle. We also added the pressure switch shown as Item 5, which, in case of steam failure, would stop the fan and thus prevent freezing up the unit.

Now our problem was solved, ex-



HOW DETAILS OF INSTALLING and controlling winter and summer air supply units not using face or bypass dampers were worked out to make them operate properly is explained in the text

cept for the condensate trapped in our steam coil. This, of course, is the biggest problem of all. This hot condensate would freeze very quickly at — 10 F. If we could only drain it out of the coil, it could not freeze. But how could that be done with the steam valve, Item 1, closed, leaving no pressure to dump the bucket traps?

This problem was solved in the following manner. We have no steam pressure to operate our bucket traps to empty the water out of the coils, and, besides, we have a vacuum in the coil. So, we break the vacuum with a stainless steel bellows in a thermostatic trap, Item 2, and bleed the dripping to an atmospheric sewer, Item 3. This arrangement breaks the vacuum. Now, all we need is pressure to operate the bucket traps. So, we turn to hydraulic pressure. We placed a minimum dimension of 18 in. on the coil condensate outlet to the top of the bucket trap, which is approximately ¾ lb pressure that we further break down as follows:

¼ lb to operate the bucket
¼ lb to operate 15° check valve, leaving
¼ lb for condensate to flow freely out of the coil where it can't freeze.

On the converse cycle, when the low limit stat, Item 4, calls for steam to satisfy 40 F, the thermostatic trap, Item 2, lets the air in the coil pass out to the atmospheric sewer (Item 3). The coil instantly flashes hot without stratification and our unit continues to run without freezing up.

We have operated over 60 such installations for the past five years without resorting to face and bypass dampers, and without freezing up our air supply units.

ASTM APPROVES EMERGENCY PROVISIONS

THE AMERICAN Society for Testing Materials has recently — through its administrative committee on standards — approved a number of new standards and significant revisions. It has also approved several emergency alternate provisions set up to expedite production and conserve strategic materials.

These emergency alternate provisions apply to the following specifications (among others):

Seamless Cold Drawn Intermediate Alloy Steel Heat Exchanger and Condenser Tubes (A 199-46) (EA — A 199).

Seamless Intermediate Alloy Steel Still Tubes for Refinery Service (A 200-46) (EA — A 200).

Welded Alloy Steel Boiler and Superheater Tubes (A 249-47) (EA — A 249).

Seamless Alloy Steel Boiler and Superheater Tubes (A 213-50T) (EA — A 213).

Seamless and Welded Ferritic Stainless Steel Tubing for General Service (A 268-47) (EA — A 268).

Seamless and Welded Austenitic Stainless Steel Tubing for General Service (A 269-47) (EA — A 269).

Seamless and Welded Austenitic Stainless Steel Sanitary Tubing (A 270-50) (EA — A 270).

Seamless Austenitic Chromium-Nickel Steel Still Tubes for Refinery Service (A 271-47) (EA — A 271).

Seamless and Welded Austenitic Seamless Steel Pipe (A 312-48 T) (EA — A 312).

Mock-Ups Used To Plan Air Distribution for Superliner

THE DISTRIBUTION OF AIR in staterooms and similar areas aboard a ship where sleeping quarters are involved is somewhat more critical than is the usual installation insofar as air motion is concerned. Ceiling soffits and other obstructions are factors which must be considered in the diffuser design and placement. A simple and easy means of adjusting the air pattern to suit the individual room arrangement is required.

The diffusers used on the $70 million, 51,500 ton, 990 ft, completely air conditioned S. S. United States — which was launched last June and is scheduled to be commissioned in 1952 — were designed specially for this application, and in most cases incorporate a central light fixture. The diffusers are constructed of heavy aluminum sections fabricated by electric arc welding with every effort made to provide the beauty necessary to be in keeping with the decor as well as the ruggedness essential for marine service.

The pattern adjustment for the various spaces is accomplished by means of baffles installed in the neck of the diffuser so as to intercept the air stream or limit the throw as required. These baffles are not visible from the room side of the unit; however, they are installed so that they can be readily adjusted on the job if rearrangement of furnishings or the space make this advisable. The diffuser units are finished with a fire resistant paint in a variety of colors to suit the several color schemes.

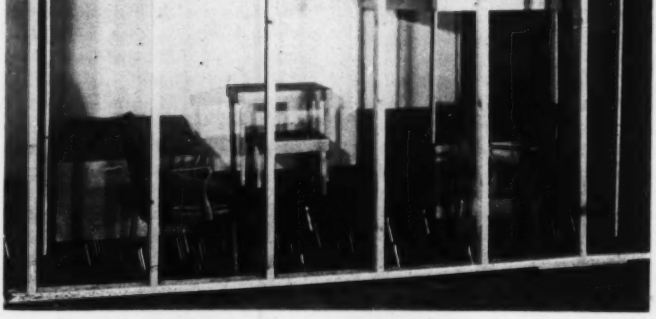
The development of these diffusers was made possible by the close cooperation of the ship's architects, (Gibbs & Cox), representatives of the owner (United States Lines), and the ship builders (Newport News Shipbuilding & Dry Dock Co.), for it can readily be appreciated that for a project of this size there were many problems, ranging from the color of the outlet to rearrangement of other equipment above the ceiling.

There are approximately a thousand staterooms and each required special consideration to assure draftless diffusion. Mock-ups of typical stateroom arrangements were therefore constructed at the air distribution laboratory of the diffuser manufacturer to study the problems involved. In all, 30 separate mock-ups were constructed and tested.

Each room is to be equipped with a thermostat control so that the occupant can change the temperature of the space to suit his individual requirements. The supply unit in most cases incorporates a light fixture, and as a portion of this fixture protrudes into the duct at the take-off or neck of the unit, it has some influence on air pattern and the design of the diffuser had to be such that it took this into consideration to minimize the effect as much as possible.

Numerous compressors of large capacity will provide refrigeration for air conditioning the superliner, and hundreds of ventilation heaters, convectors and heating elements are used in its heating system.

ONE OF THE MOCK-UPS used in developing methods of air distribution for the big ship. Furniture shown does not represent that to be used, but only its position



By W. W. Kennedy, Chief Engineer, Air Distribution Development, Barber-Colman Co.

Steel Engineers Discuss Heat Relief, Air Filters

The Association of Iron and Steel Engineers Hears Papers on Heat Relief in Industry, the Methods of Reconditioning Oil for Air Filters, and Report on Steel Plant Air Filter Data

HEAT RELIEF in industries, reconditioning of air filter oils, and an initial report on the development of data on steel plant air filters were among the subjects discussed at the 1951 annual convention of the Association of Iron and Steel Engineers, held in Chicago last month.

Methods of Providing Heat Relief

Bartlett R. Small, Staff Engineer, Mechanical Engineering Dept., Aluminum Co. of America, pointed out in his paper that the metal producing industries are obtaining increased returns from facilities that provide employee relief from hot working conditions. Good results are often obtained by use of radiant heat shielding at furnaces, by local or spot cooling with "naturally cooled" air, and by crane cab air conditioning, he said.

As primary treatment for hot areas, building ventilation rates are being economically increased through use of gravity ventilators and fan roof ventilators. For severe conditions, recently developed methods of radiant heat shielding by means of semi-portable reflective sheet metal curtains have created considerable enthusiasm. In the hot glass industry, no other method has approached the benefits of radiation shielding, he stated.

Severe conditions that are unsuited to radiation shielding have been satisfactorily relieved by a third step, known as local or spot cooling, Mr. Small said. Washed air, cooled by evaporative heat exchange and delivered from grilles at 75 F to 80 F during the warm days of summer, can be used.

Radiant heat shielding showed some rather startling results at an open hearth type of furnace that is used for remelting aluminum throughout the industry, Mr. Small reported. The steel casing of a furnace read 280 F. A 1/16 in. thick sheet of ordinary mill finish aluminum was set out 6 in. in front of it and clamped against the face of the vertical buckstays. This reflective radiant shield came to equilibrium at the unusually low surface temperature of 85 F, when the room temperature was 66 F in the winter time.

The chimney effect of this unobstructed stack, bounded on the front by the shield of 8 ft effective height and open at the bottom, produced a 25 F air temperature rise. Sufficient cooling of the brickwork and shell was thus assured with the shell heating up only 10 F to 290 F. The possibility of overheating the brickwork and shell is a real one and should be checked by thermocouples on any new application of shielding.

One of the outstanding installations to date of radiant heat shielding was made by a leading glass company, according to Mr. Small. Some glass annealing furnaces operating at high temperatures were totally shielded. Because of the large heat release and a low roof, the shielding sheets were extended right up to the roof where ventilators were sized to balance the requirements. The method of mounting the shields was by welding threaded studs to the columns, using a stud gun. The sheets thus can be removed as necessary by removing wing nuts.

Spot or local cooling is another important means of accomplishing industrial heat relief. This method might be divided in three classes:

1) Recirculated room air driven by man cooler or pedestal fans.

2) Raw outside air delivered by high velocity fans as a direct blow or through a duct system and grilles.

3) Outside air cooled by evaporation and in most cases conveyed by duct work.

There are three simple precautions to be observed when applying evaporative cooling, Mr. Small warned:

1) Use all outside air and never recirculate in hot weather.

2) Maintain adequate air motion around the men who are to be benefitted. Though not scientifically developed, a minimum of 300 fpm and up to a 1000 fpm velocity under severe heat conditions have been found successful. Adequately equipped registers that permit 80 percent velocity turndown are essential, thereby extending usefulness of the method to spring, fall and often winter.

3) Provide a split system whereby evaporative cooling is used in combination with motorized roof exhaust ventilators and sufficient outdoor air inlet openings. In this way the greater volume of raw outside air holds down the overall temperature level in all areas of an obviously hot operation, coupled with the ability to sweep out the spent washed air.

Alcoa's latest remelting furnace building, and the second to be equipped with evaporative spot cooling, uses the split system with roof exhausters. The duct downcomers supply low level diffusers located some 8 ft off the floor. This 1300 ft x 180 ft building is supplied with

a total of 200,000 cfm of washed air in summer and in winter this amount is tempered to 65 F for make-up air to the various smoke, fume and dust exhaust systems in several interconnecting buildings.

Alcoa has an aluminum producing plant in Texas that receives 120,000 kwh from 120 generators driven by natural gas burning radial engines. The engine control cubicles have air supply grilles on three sides down near the floor, from which about 10,000 cfm of cooled, washed air is distributed in the working areas around their respective engines. To assure good conditions along the outside wall areas three air grilles are similarly located in the enclosed supporting stand for the oil filter that serves each engine. An air discharge of 6000 cfm is delivered here. Grilles are thus delivering 16,000 cfm of pleasant air motion at 1000 fpm grille effective velocity over the 20 ft x 27 ft floor area given to each engine, and management is very pleased with results.

Incidentally, the 35,000 cfm air washer for each engine is also efficient as an air filter. Of this air volume that enters the continuous basement, 13,000 cfm is drawn through the 1000 kw generator windings and 6000 cfm by the scavenging air blower.

Mr. Small also described other Alcoa installations.

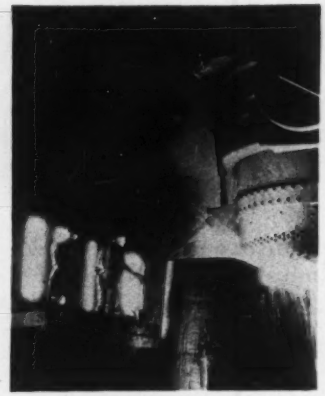
In closing his discussion of heat relief, Mr. Small said that a brief summary of reasonably safe procedure would be:

a) To look for every means to effect radiant heat protection in the area under complaint — a sort of "heat control housekeeping." Shield or reflectively paint every surface over 200 F.

b) To ascertain if good roof ventilator or roof monitor practice and performance are being followed.

c) To spot cool with washed air those local areas as an additional step if required.

In the discussion following Mr. Small's presentation, John H. Clarke, Staff Engineer, Standard Oil Co. (Ind.), said that evaporative cooling should be used with caution and should not be mis-applied to cases where the resulting humidity conditions would not be satisfactory. Mr. Clarke said that high duct velocities keep the cost of the ducts down, and



that as high as 6000 fpm is used in industrial work. Also, with evaporative cooling, heat pick-up in the ducts must be allowed for, and the use of the higher duct velocities minimizes this problem.

George F. Haines, Jr., of the Industrial Hygiene Foundation, presented data showing the reduction in heat radiation by screening. [See his article in the September 1951 HPAC]. Discussions by Allen D. Brandt and by Charles J. Enlind were also given.

Reconditioning Air Filter Oils

Removing the solids from air which have an abrasive effect on impellers of blowers was the application of air filters under consideration by George Findlay, Lubrication Engineer, Republic Steel Corp., in his discussion of oil reconditioning. For this service, the air filters must run on a continuous cycle to be effective, he said, and the oil reconditioning system must also remove contamination from the air filter oil continuously.

He then described an oil reconditioning installation at a steel mill. The oil reservoirs of the two banks of air filters are connected by a 4 in. drain line. Flow from the reservoirs is restricted by a valve so that about 10 percent of the oil goes through an overflow line and through sight glasses to the oil receiving tank, so that the operator can be sure that he is maintaining the proper oil level in the air filters. Rotary pumps force the oil through activated earth filters, after which the oil is returned to the air filter reservoirs. This method of oil reconditioning permits the job to be done with the minimum of labor and disposal problems.

In a second installation, a larger settling tank was used to reduce the build-up on the cartridges of the activated earth filters. This second installation has connections allowing the oil lines to be blown out with 100 lb plant air, but this blowing out has not been necessary to date.

Electric soil heating cable is run in the air filter reservoirs and in the oil lines to avoid "sticking" in cold weather.

Oil reconditioning installations of this kind in the steel industry extend the intervals of periodic impeller replacement or repair for turbo blowing equipment, and the maintenance savings quickly amortize the investment in the filtering and reconditioning equipment, Mr. Findlay stated.

To Develop Air Filter Data

A. H. Arbogast, of Bethlehem Steel Co., and chairman of the Steel Plant Air Filter Committee, gave an "initial report" on the committee's plans, which are confined to studies of air cleaning requirements for mechanical and electrical equipment protection and do not include applications to industrial hygiene or to atmospheric pollution.

The necessity for equipment protection from dusts is a definite mechanical and economic requirement for the successful engineering and operation of mill motors, air compressors, turbo-blowers, etc., he said.

A basic program of approach to a study of this problem has been agreed on by the committee, is based upon the collection of data from various plant sources.

This data, described in detail on a questionnaire, would provide a basis for investigating or evaluating:

1) The efficiencies of various air filter media with dusts of various sizes, concentrations and chemical and physical compositions.

2) The degree of protection provided or required in terms of operation and maintenance experience with the mechanical and electrical equipment being protected.

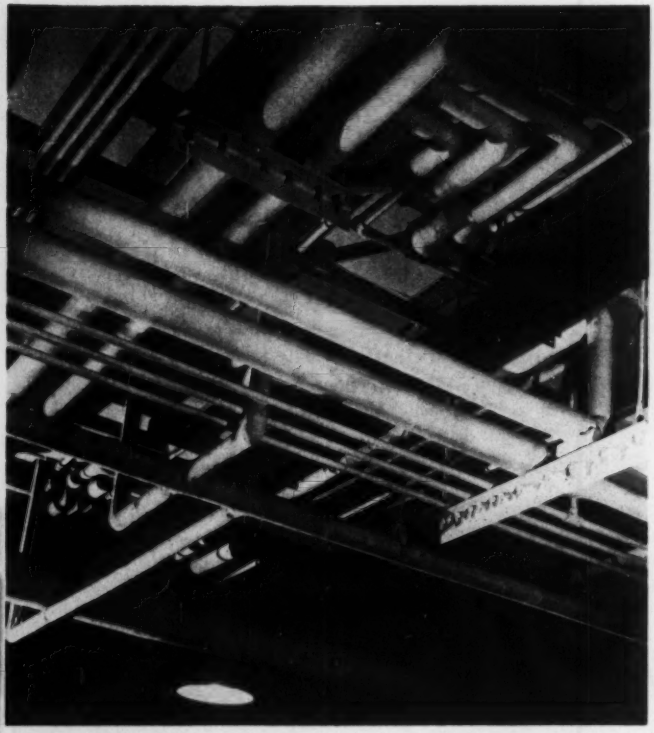
3) The chemical and physical characteristics of adhesive adjuncts.

[The complete papers given at the meeting and the discussions on them are to be published in the journal of the Association of Iron and Steel Engineers.]

Carefully Planned Air Conditioning and Piping Services at New Upjohn Plant

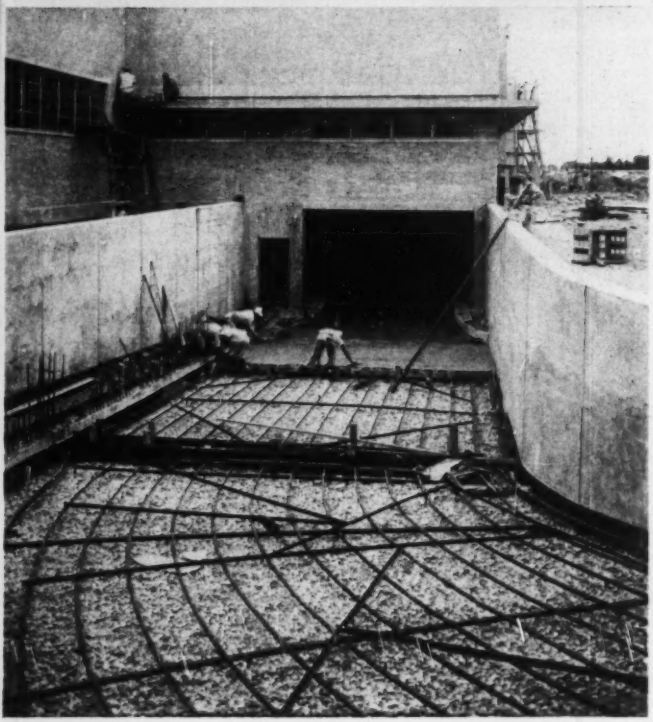
The new Upjohn plant was planned to provide the best possible accommodations for manufacturing the company's products (present and future), to insure maximum efficiency and economy consistent with their high quality, and to provide facilities and conveniences that will conserve the health, time and energies of employees and contribute to their enjoyment of their work. The result is a group of buildings with a total of 33 acres under roof designed for exceptional flexibility in usage and for minimum maintenance

KNOCK-OUT PIPE SLEEVES — more than 25,000 of them — were provided to accommodate installation of process equipment at The Upjohn Co.'s new pharmaceutical plant at Kalamazoo. In areas such as that shown here, they were placed on 4 ft centers in two directions before the floor slab was poured. All piping services, power distribution and load centers are in the service basement, are brought up with short lines through the first floor slab directly at the points where needed



AT RIGHT

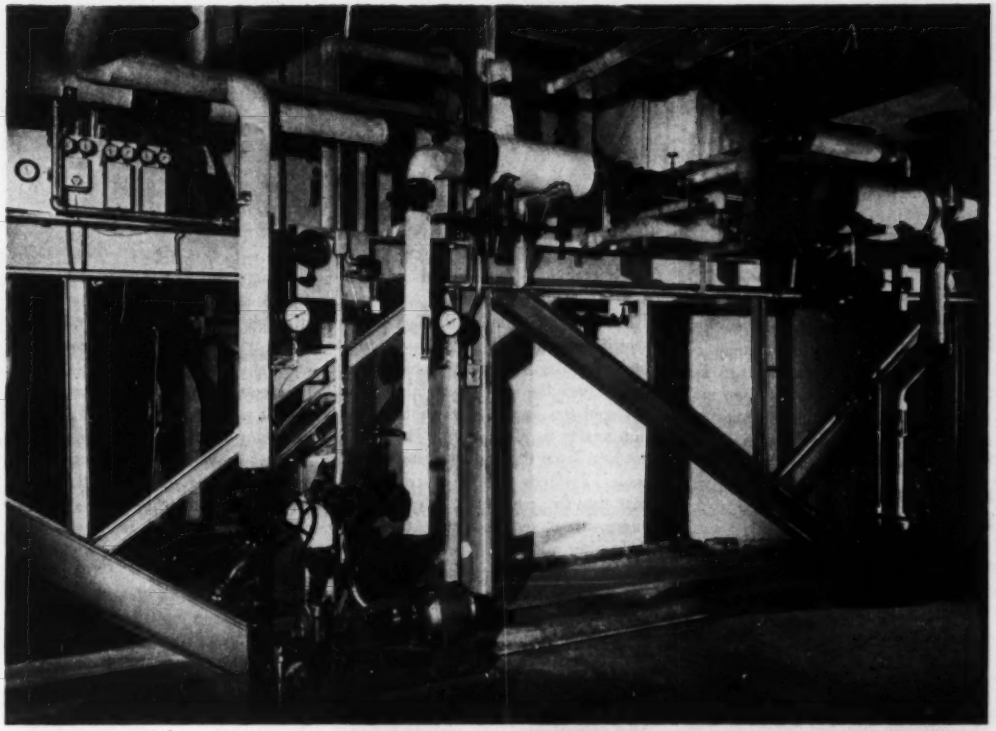
AIR CONDITIONING IS ESSENTIAL to Upjohn's manufacturing activities, and production operations are concentrated in a 360 ft wide air conditioned section through the center of the building, which is 870 by 1125 ft. Because of need for maintaining precise control in many different departments, 120 separate conditioning systems — of which 75 are in the central manufacturing area truss space — are used. Systems range from simple comfort cooling to combinations of ultraviolet germicidal lamps, chemical dehumidifiers, and electrostatic air cleaners for holding temperatures within 2 deg and humidities ranging between 10 and 50 percent

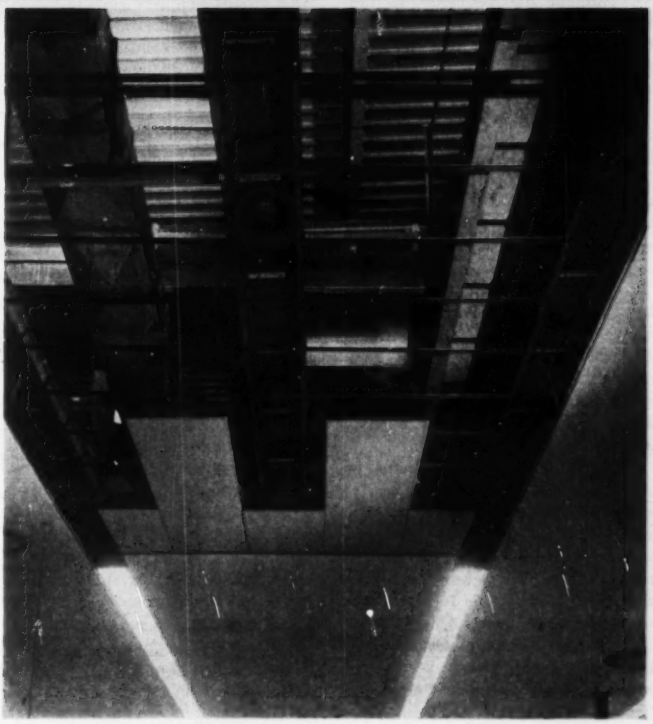


AT LEFT

PIPING IS ARRANGED at five carefully planned levels below the basement ceiling. The method keeps the entire manufacturing floor free of distribution piping and conduits, permits maintenance changes and connections to be made in the basement — which simplifies housekeeping and cleanliness in manufacturing areas. The piping services shown include steam and condensate lines, air, gas, vacuum, hot and cold water for domestic use, and sprinkler lines

RAMPS TO UNDERGROUND BUS LOADING concourse have snow melting coils (shown here before concrete was poured) through which a 50 percent antifreeze solution will be circulated to prevent ice and snow on the approaches. Plant is located on a 1500 acre rural site, and there is an 8 acre paved parking space for those driving to work as well as regularly scheduled busses — from which passengers alight in the covered concourse on the plant's lower level. Entire layout provides for expansion, and there is space in boiler house to double present installation of three 750 hp boilers. The Austin Co. were the engineers and builders.





ACOUSTICAL TILE AND continuous troffer lighting are incorporated in suspended ceiling of new patented design. Air conditioning equipment is installed above acoustical ceiling on reinforced concrete platforms supported by welded H-section roof trusses. Individual deep troffer beams formed from heavy gage sheet steel extend from truss to truss and are fastened to bottom chords. Air conditioning installation comprises some 100,000 lineal feet of duct work, and air is handled through 2377 supply and exhaust outlets at rate of 2,180,000 cfm. Conditioned air is supplied at rate of 1,220,000 cfm

Sam Lewis' Page

. . . . . *pertinent comment on practical problems*

• INFORMAL COMMENT on heating, piping and air conditioning matters is given in this regular feature by Samuel R. Lewis, consulting mechanical engineer and a member of HPAC's board of consulting and contributing editors.

HOT WATER HEATING FOR BIG BUILDING

AS PART OF A proposed program in a 16 story building, it is desired to convert the heating system so that the cast iron radiators will employ warm water. The building is about 208 ft high. It has two steam supply mains, one in the attic feeding down-going risers about 20 ft apart all the way around the perimeter of the building. Each riser serves a radiator below a window and close to the outside wall. A return riser commences near each steam supply riser and runs from the 16th story to the basement, where a return main leads to a vacuum pump. The building is not so old but that the radiators are of relatively modern type with connecting nipples between the sections at both top and bottom.

I realize of course that no one should call these things "radiators," but nomenclature in heating moves very slowly and we have no word that describes accurately this type of heat transmitter. Gradually we are learning to cease thinking of its capacity in terms of square feet, anyway.

In operation, such a radiator is a combination of a convector and a radiator. When supplied constantly with steam and if properly drained, it is a condenser. One of the easiest methods of measuring how much heat the object transmits is to catch and to weigh the amount of water that it condenses. The end sections and the lower parts of every section of a cast iron column type radiator condense more steam per square inch of surface than is condensed by the upper parts of intermediate sections. The taller the radiator, the less business it does, since the air rising along the vertical surfaces becomes warm as it passes the lower parts and does not cool the upper parts of the section nearly as effectively. The radiant heat from the end sections "sees" cooler surfaces and thus transmits heat rapidly, while the sides of the intermediate sections must look at each other and cannot see very much surface cooler than themselves. As a convector, such a radiator does best when air circulates freely all around it. Radiators placed tightly against an outside wall have failed to satisfy, but when moved away 2 or 3 in. so as to gain passage for air flow, have proved adequate.

There is a separate steam supply main in the basement of this building, serving the radiators on the first story, but the vacuum return main in the basement drains the radiators on all of the 16 stories.

The cast iron radiators were tested at the point of manufacture to 100 lb cold water pressure. There are some instances where, through ignorance or accident, such radiators have withstood internal pressure in excess of 100 lb per sq in. I have no objection to allowing them to operate regularly with 50 (or less) lb per sq in. water pressure. For each foot in height, a column of water weighs a trifle less than 0.44 lb. Thus, within the 50 lb pressure limit, the radiators could serve a building about 114 ft high, or eight of the sixteen 13 ft stories of this building.

I would therefore install a new hot water return main in the attic, paralleling the existing overhead steam main. A branch, usually 1 in. in diameter, would connect this new main from the top of each existing vacuum return riser.

Just below the eighth story radiators, all of the existing steam and condensate risers would be cut and be plugged. The radiators on the eighth story will receive hot water through the present down-coming steam riser, and water from them will return to the attic main through the present down-coming condensate risers, which, however, will become up-going hot water return risers.

The pipe sizes will tend to equalize as to flow resistance, since the radiators on the 16th story will have oversize flow pipes and relatively small return pipes while the radiators on the eighth story — being more distant — will have the return pipes and flow pipes more nearly commensurate. The bellows or float valves will be removed from all of the old vacuum traps at the radiators. Water circulation to the radiators on the stories from the ninth to the 15th, as far as pipe sizes are concerned, will balance without any trouble. There will be a steam-to-water converter, an expansion tank and a circulating pump (or several pumps if desired for zoning) for the converted system.

Concerning the first to the seventh stories, the existing down-coming steam and vacuum return risers are to be plugged above the seventh story radiator level.

The existing steam supply main for the first story will be amply large, with hot water, to supply all radiators from the first to the seventh stories. To connect the bottoms of the former steam risers to this main in the basement will be comparatively easy in these days of gas cutting and welding.

The existing former vacuum return mains in the basement are ample in size for all the radiators on the first to the seventh stories inclusive.

A separate steam-to-water converter, a pneumatic expansion tank and a circulating pump will complete the job. The pressure on the first story radiators will be 91 ft × 0.44, or about 40 lb, which is well within the 50 lb pressure limit.

QUESTION of the Month

QUESTIONS ON heating, piping and air conditioning asked by HPAC's readers are answered here each month. We hope you find these practical comments of regular interest, and invite you to contribute either a question, or an answer to a published question, for next month's issue. We'll be glad to hear from you. Just address the Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Illinois.

HOW TO INSULATE STEAM TRACER LINES

[*Two different readers have recently inquired about methods of designing steam tracer lines and their insulation. The following comments on how such a line was designed have been furnished to answer these requests. Comments on this problem, and particularly references to any available tables or charts containing helpful data, would be appreciated.—The Editors.*]

IN ALMOST EVERY plant, the device of insulating air lines or water lines together with steam supply headers of the smaller sizes, which are routed in the same direction, has been practiced to prevent freezing. In the case of our 2 in. steam supply leader, 1½ in. air line, and 2 in. caustic soda line this simple procedure of insulating as a unit could not be used since steel pipe above 100 F in caustic soda service is subject to excessive corrosion and potential embrittlement.

The caustic soda to be delivered is at a temperature of 85 to 90 F and we wished to maintain this temperature substantially unchanged. (Below 70 F, 50 percent caustic soda is difficult to pump and it freezes at 58 F.) We made some rough trial and error calculations using conventional methods to determine the heat loss from the entire array of pipes at 85 F when insulated with a single, standard mineral wool blanket under average ambient temperature conditions. These calculations showed the heat loss to be acceptable; a second calculation indicated that standard 2 in. 85 percent magnesia pipe covering for the 125 psig steam line would permit approximately the same heat transmission from the steam line to the space around the other pipes. The final installation then was made with 2 in. standard 85 percent magnesia pipe covering on the 125 psig steam line; the air and caustic lines were grouped around the insulated steam line as closely as possible; and the entire array was wrapped with a single mineral wool blanket, with roofing paper for weather protection.

In practice this installation has operated satisfactorily for almost three years. There has been no evidence of excessive steam condensation in the supply header, caustic temperatures have ranged from 75 F to 100 F depending on weather conditions, and the installation has required no maintenance beyond valve repacking and periodic checks of steam traps.—F. A. WOOLFLEY, Stauffer Chemical Co.

WANTS IDEAS FOR EXHAUSTING GASES FROM DIESEL LOCOMOTIVE REPAIR SHOPS

You are invited to answer the following question from the engineering department of a railroad. Please address your reply to the Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

"We have a problem at several of our diesel locomotive repair shops in regard to excessive exhaust gases coming from the engines when run in the shops. At one shop, we have exhaust hoods mounted just above the engine outlets, connected to 16 in. stacks with motor-driven roof ventilators. This method does not appear to be satisfactory.

"We would appreciate any information, or references to published articles, which might help us to solve the problem."—H.J.B.

LOOSE-LEAF BOOK INDEXES OFFICE DATA

IN REPLY TO THE question raised in a recent issue about ideas on filing data, the following system has been used by me for some considerable time and has been found to be satisfactory in every respect.

The basis of the system is a loose-leaf book with the subject matter arranged alphabetically. It has been found preferable to the loose card system, as the book or books can easily be transported from office to site or residence.

Subject matter is always filed under the noun and where there is the slightest possibility of doubt, cross-referencing is employed. Information is gathered on items of equipment and installation work from periodicals, journals, manufacturers' literature and practical experience and is recorded on the loose-leaf sheets. In operating this system it has been the office practice to jot down all entries in pencil, and as soon as the sheet is full of pencil notes the information is typed on to a new sheet.

This system has the advantage that one of its functions is to form a master index to all information which might be of interest to the office and which is contained in the various journals and periodicals. This saves having to wade through lengthy individual indexes of material, which, in many cases, may not be concerned or connected with the type of work dealt with.

It should be emphasized that the only thing that must be remembered with this system is that the noun and not the adjective controls the location of the information sheets in the book.

As a sample, one of our index sheets reads in part as follows:

PUMPS — RECIPROCATING: INFORMATION
HPAC Jan. 1949, page 133.
Data sheet on installation and operation.
HPAC Feb. 1949, page 103.
Data sheet on installation and operation.

—A.D.G.I. (Consulting Engineer)

The Law and Your Profits

Detailed Statements

IT MAY HAPPEN in the course of business relationships that the refusal of a seemingly unreasonable demand will bring on an avalanche of expense, as one contractor recently discovered. Particularly is this the case with delinquent accounts, before or after legal proceedings have been initiated.

The Soanso Heating & Piping Co. sued Frank Sumfella & Sons (the names are imaginary) for the agreed price of material furnished and labor performed at Sumfella's request. Sumfella then formally demanded that a bill of particulars, "stating in detail the facts, dates, time, amounts, occasions" mentioned in the suit be furnished within five days. Certain mention was merely as "balances due" on this and that job or contract.

Soanso, because he felt that a detailed bill was out of order, failed to comply with the demand. One week before trial, Sumfella served notice on Soanso that six days later (December 13) he would ask the court to forbid Soanso from offering as evidence "any matter pertaining to the accounts, allegations and things mentioned" in Soanso's complaint. The ground for this was that Soanso had failed to deliver the demanded bill of particulars. Said the trial judge on that date:

"I'll continue this matter until 10:00 a.m. December 15, and I'll rule at that time. Meanwhile we'll see what the attorney for the plaintiff does with reference to this bill of particulars."

When the 15th rolled around, Soanso's counsel having failed to furnish the bill of particulars within the time allowed, the court granted Sumfella's motion, thus precluding Soanso from pressing his claims for balances due on contracts.

The Soanso Heating & Piping Co. appealed to the supreme court of the state, contending the trial court's order was wrong because, among other reasons, (1) Sumfella had the details anyhow; (2) by filing an answer and "cross complaint" he had waived his right to demand a bill of particulars; (3) he was negligent in not serving sooner his "motion to preclude"; (4) he should have demanded, if anything, not a bill

of particulars but a copy of the account; and (5) the court's order was "a penalty contrary to the ends of justice".

Soanso further contended that Sumfella, instead of abitrarily demanding a bill of particulars, should have first tried to convince the court of its necessity by reason of Soanso's claims being "too general . . . to be readily understood". As a clincher, the heating contractor invoked a state law providing that "sham and irrelevant answers and replies . . . may be stricken out on motion and upon such terms" as the court may impose.

Despite these arguments, the higher tribunal saw "no merit" in Soanso's contentions. Each of four items calling simply for balance on contract, followed by such notation as "Jones job", entitled Sumfella to demand a bill of particulars, said the court. Its opinion rebuked Soanso for persistently refusing not only to comply with Sumfella's demand "but to take advantage of the opportunity given" by the lower court "even up to the moment of trial".

The justice went on to observe that Soanso's briefs insisted upon his right to his day in court but without furnishing any bill of particulars. After reviewing Soanso's enumerated contentions, the supreme court looked at Sumfella's demands for the detailed bill "realistically":

"It is obvious" that these demands referred directly to four unitemized claims in Soanso's statement. All the others were itemized "*in the greatest detail*". Only in these four, each one for a material sum, "do we find entire lack of itemization. Only in these four do we find one single item set out as 'balance due' " or any reference to a contract to which attention "is specifically directed in the demand itself".

The court saw "no reasonable chance" that Soanso could have misunderstood the demand as directed to these items. It held that Sumfella properly made that demand, and that Soanso by failure to comply "subjected himself . . . to the order complained of". The lower court's judgment was confirmed and Soanso's motion for a new trial was denied.

In short, the Soanso Heating & Piping Co. lost the case and was accordingly out of pocket some thousands of dollars. This outcome might have been avoided if Soanso had supplied the requested items in full detail, instead of regarding Sumfella's demand as a mere legal quibble.

[Note: While this discussion applies to an actual case, it must be remembered that legal rules vary in different states.]

William Hurd Hillyer, author of this article, is a contributor to a number of banking and financial publications and has written several books on business. A former vice president of the Atlanta Trust Co., his work there gave him a practical legal background.

V-Belt Drive Data

DATA sheet

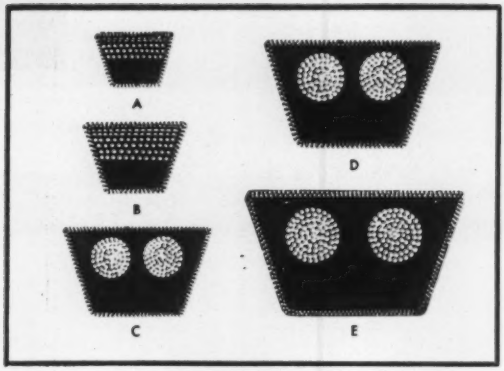
Excerpted by permission from article on V-Belt Drive Fundamentals for Engineers, by Frank H. Rumble, Texrope Drive Dept., Allis-Chalmers Mfg. Co., published in the Allis-Chalmers Electrical Review

CHARACTERISTICS OF MOTORS under average operating conditions

	Starting torque, percent	Pull-out torque, percent	Constant or variable speed
Squirrel cage motors			
Normal torque (line start)	110 to 150	200 to 250	Constant
Normal torque (compensator start)	110 to 150	220 to 250	Constant
High torque	200 to 300	200 to 400	Constant
Wound rotor motor (slip ring type)	150 to 250	200 to 250	Variable
Synchronous motors			
Normal torque	110 to 125	150 to 250	Constant
High torque	160 to 200	250 to 400	Constant
Single phase motors			
Repulsion and split phase	230 to 500	250 to 400	Constant
Capacitor	150 to 200	175 to 200	Constant
Direct current motors			
Shunt wound	50 to 100	150% Peak Momentary Load	Both
Compound wound	50 to 100		Both

SERVICE FACTORS for various types of prime movers. To arrive at "actual" horsepower capacity to be used in drive selection, multiply rated horsepower of motor (nameplate rating) by the service factor to assure proper margin of safety

Applications	Electric motors A-c: Squirrel cage: Normal torque Line start	Squirrel cage: Normal torque Compensator start	Squirrel cage: High torque	Squirrel cage: Wound rotor (slip ring)	Synchronous: Normal torque	Synchronous: High torque	Single phase: Repulsion and split phase	Single phase: Capacitor	D-c: Shunt wound	D-c: Compound wound	Engines Gas and diesel: 4 or more cyl. above 700 rpm	Engines Gas and diesel: Steam	Engines Gas and diesel: Line shafts and clutch starting
Compressors													
Centrifugal or rotary	1.2	1.2	...	1.4	1.4	...	1.2	1.2	...	1.2	...	...	...
Reciprocating — 3 or more cylinders	1.2	1.2	...	1.4	1.4	...	...	...	1.2	...	...	...	...
1 or 2 cylinders	1.4	1.4	...	1.5	1.5	...	...	...	1.2	...	...	...	...
Fans and Blowers													
Centrifugal, induced draft, exhausters	1.2	1.2	...	1.4	...	...	...	...	1.4	...	1.4	1.5	1.5
Propeller, mine fans	1.6	1.6	1.6	1.6	...	1.8	...	...	1.4	...	1.6	...	...
Positive blowers	1.6	1.6	...	2.0	2.0	1.8	...	...	...	...	1.6	...	...
Pumps													
Centrifugal, gear, rotary	1.2	1.2	1.4	1.4	...	...	1.2	1.2	1.2	...	1.2	...	...
Reciprocating — 3 or more cylinders	1.2	1.2	...	1.4	1.4	1.6	...	...	...	...	1.8	1.8	...
1 or 2 cyl., dredge pump	1.4	1.4	...	1.4	...	...	...	...	...	...	2.0	2.0	...



V-BELT cross sections

GENERAL V-BELT suggestion table, showing recommended belt sections for different speeds with various sizes of motors. Table is result of experience in engineering thousands of drives, is based on nominal horsepower

Motor hp	Motor or driven machine speed, whichever is the greater												
	3600	3200	2800	2400	2000	1800	1450	1200	900	720	600	514	450
½–¾	A	A	A	A	A	A	A	A	A	B	B	B	B
1–1½	A	A	A	A	A	A	A	A	A	B	B	B	B
2–3	A	A	A	A	A	A	A	A	B	B	B	B	B
5	A	A	A	A	A	A	A	A	B	B	B	B	B
7½	B	B	B	B	B	B	B	B	B	B	B	B	B
10	B	B	B	B	B	B	B	B	B	C	C	C	C
15	B	B	B	B	B	B	B	B	B	C	C	C	C
20	B	B	B	B	B	B	B	B	B	C	C	C	C
25	B	B	B	B	C	C	C	C	C	C	C	C	C
30	B	B	B	B	C	C	C	C	C	C	C	C	C
40	B	B	B	B	C	C	C	C	C	C	C	C	C
50	B	B	B	B	C	C	C	C	C	D	D	D	D
60	B	B	B	B	C	C	C	C	C	D	D	D	D
75	B	B	B	B	C	C	C	C	C	D	D	D	D
100	B	B	B	B	C	C	C	D	D	D	D	E	E
125	B	B	B	B	C	C	C	D	D	D	D	E	E
150	B	B	B	B	C	C	C	D	D	D	D	E	E
200	B	B	B	B	C	C	C	D	D	E	E	E	E
250 and Over	B	B	B	B	C	C	C	D	D	E	E	E	E

Note: The belt sections suggested for higher speeds indicate the belt section which can operate satisfactorily without exceeding 5000 fpm belt speed and without overflexing the belts on too small diameter sheaves.

PERMISSIBLE minimum sheave sizes (pitch diameters) for V-belt drives

Belt cross section	Sheave size, in.
A	3.0
B	5.4
C	9.0
D	13.0
E	21.6

RECOMMENDED minimum sheave sizes (pitch diameters) for drives

Belt cross section	Sheave size, in.
A	4.0
B	6.0
C	10.0
D	14.0
E	23.0

Heating, Piping & Air Conditioning

THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

JOURNAL SECTION

Venting Hot Water Heating Systems

By F. E. Giesecke*, New Braunfels, Tex.

SUMMARY—Forced circulation hot water panel heating systems can be vented by means of a vent placed in the main flow line directly above the boiler. Air traps in such systems need not be vented if the pressure head is sufficient to force water through the traps.

The feasibility of using this simple method of venting was demonstrated by operating results obtained in an experimental heating system which was operated during two heating seasons.

The sources of air and gases in the heating system and the procedure for removing them from the system are discussed.

A SIMPLE method of venting a panel type hot water heating system was described in an article[1] in which the author reported his experience with the system, shown schematically in Fig. 1. This experimental system consists essentially of a boiler, two circuits of coils, an open expansion tank, an open vent pipe, a pump, and a set of controls.

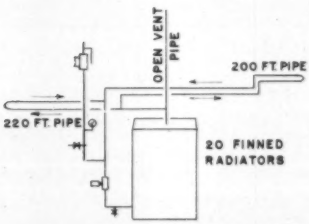


Fig. 1 — Diagram of experimental heating system with open vent pipe

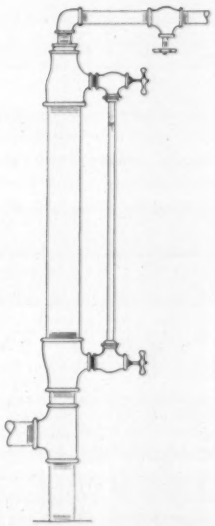


Fig. 2 — Air chamber for collecting vented gases

The coils were made partly of new 1¼-in. steel pipe with finned radiators, partly of new 1-in. wrought-iron pipe, and partly of old 2½-in. and old 3-in. pipe, the last being in position from a former heating system.

The 1-in. pipe coil was embedded in a concrete floor slab; the other pipe coils were suspended in the crawl space under the floor at approximately 18 in. below the 1-in. pipe coil. The system had one major air trap, about 18 in. high, and it had several smaller potential air traps where the pipes passed over or under floor sills.

The pump was in the return main near the boiler. The expansion tank was connected to the return main on the suction side of the pump and near the pump. As gases were liberated in the boiler, they passed out through the open vent pipe, the upper end of which was about 3 ft above the top of the expansion tank.

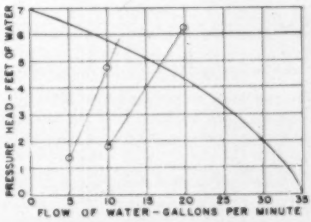


Fig. 3 — Pump performance chart

*Consulting Engineer. Presidential and Life Member of ASHVE.

For presentation at the 58th Annual meeting of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, St. Louis, Mo., January, 1952.

[1] "Open for Discussion" — Dr. F. E. Giesecke Comments on Radiant Heating Problems. (*Heating, Piping & Air Conditioning*, July, 1948, p. 98).

The system operated properly, but, occasionally, a small quantity of water was thrown through the vent pipe when large bubbles of gas escaped. This could have been prevented by installing a larger or taller vent pipe, or by replacing the open vent pipe with an automatic air vent.

Object of Test

While it seemed improbable that air or gases could escape from the system through the joints or by any means other than the vent pipe (although some engineers thought such escape possible) it seemed desirable to establish the practicality of a single vent by further experiment, the results of which are recorded and discussed in this paper.

The vent pipe of Fig. 1 was replaced by an air chamber made of an 18-in. section of 2-in. pipe fitted with a gage glass and a ½-in. top outlet closed by a globe valve (see Fig. 2). The air chamber was used for measuring the volume of air and gases removed from the water in the system. The pressure in the air chamber was 2½ ft water column, due to difference in height of air chamber and open expansion tank, when the pump was stopped, and rose to 4½ ft when the pump was running.

The volume of water in the system was 6.92 cu ft; the friction-head in the piping was equal to 2 ft of water. From the pump performance chart, Fig. 3, it was found that water was circulating at a rate of 30 gpm, or at about 6 fps in the 1¼-in. flow riser.

The system was filled with water from the city mains. A previous U. S. Geological Survey analysis of the water at the springs, from which the city water was obtained, indicated a bicarbonate content of 266 ppm which would yield 0.7 cu ft carbon dioxide at 110 F and 16.2 psia, the average condition of the water in the system.

The total amount of gas to be vented from the system was estimated (see Appendix A) to be about 1 cu ft, consisting of:

Air trapped when filling system	0.25 cu ft
Carbon dioxide from bicarbonates	0.70 cu ft
Oxygen and nitrogen dissolved in the filling water	0.10 cu ft

The experimental system was operated during two heating seasons, October 25, 1949 to April 26, 1950, and November 4, 1950 to April 23, 1951. In the summer period, April 26 to November 4, 1950, the system was out of operation and no water was drained out or added. No air

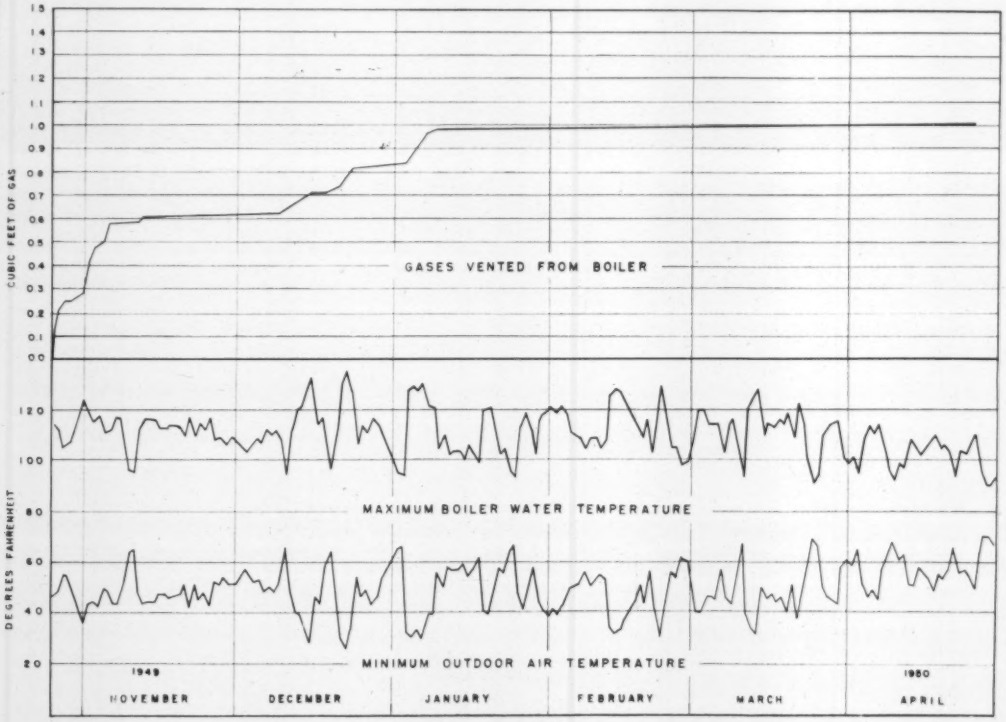


Fig. 4 — Venting of gases from boiler during first heating season (1949-1950)

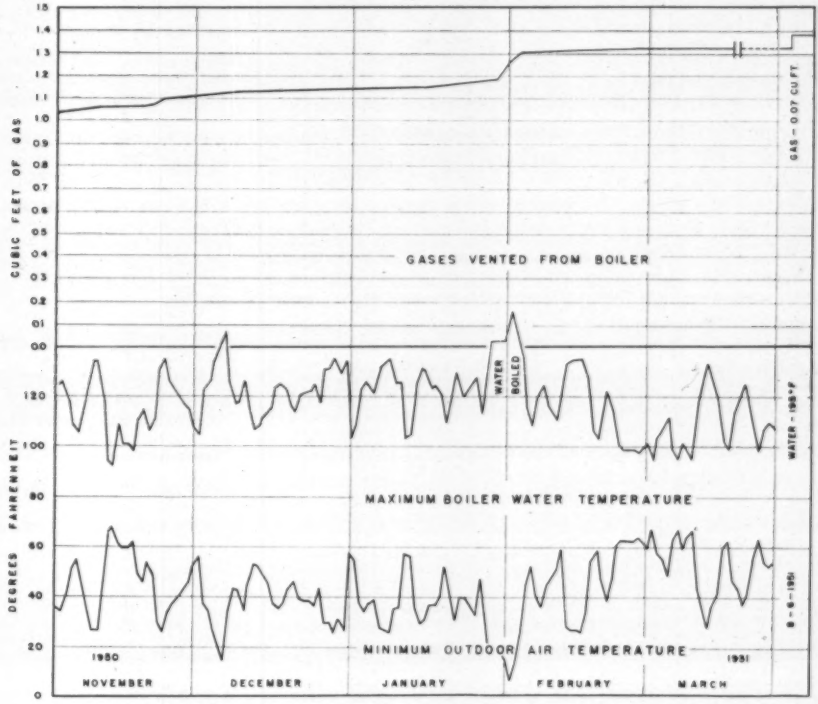


Fig. 5 — Venting of gases from boiler during second heating season (1950-1951)

was removed or added, except possibly a very small quantity passing in or out of the expansion tank.

Venting Results

First Heating System: The actual quantity of gas vented from the boiler during the first heating season is shown by the top line of Fig. 4. The lower jagged line shows the minimum daily air temperatures as recorded by the U.S. Weather Bureau at the San Antonio Station about 25 miles away.

The middle jagged line shows the maximum daily boiler water temperature as estimated according to the minimum outdoor air temperature and the setting of the controls which were set to vary the boiler water temperature from 90 F to 140 F as the outdoor air temperature varied from 70 F to 20 F.

From Fig. 4 it may be concluded:

1. That about 1 cu ft of gas was vented from the boiler to the air chamber during the 6-mo heating season.

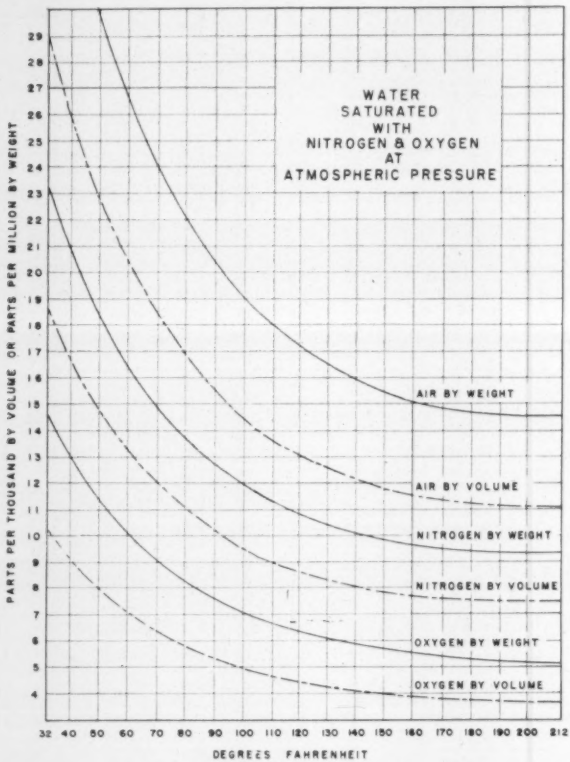
2. That during the first two days about 0.25 cu ft was vented. This quantity was probably the air which had been trapped when the system was filled.

3. That the principal portion of the remaining 0.75 cu ft was vented during three separate periods (November 12 to 17, December 1 to 15, and January 4 to 9) when the temperature of the boiler water was above 120 F. The gases vented during these periods, no doubt, were partly carbon dioxide, liberated from the bicarbonates, and partly oxygen and nitrogen, dissolved in the 80 F water with which the boiler was filled and of which a part was released when the water was heated above 80 F.

Second Heating Season

At the beginning of the second heating season, the system was full of water from the previous season. It was assumed that the system contained no gases, except those dissolved in the water or bound in bicarbonates which had not broken up during the first season.

Venting results are shown in Fig. 5. The top line shows that the gas vented in four months and 19 days was less than 0.3 cu ft. One-half of this quantity was vented during the six days, January 30 to February 4, when, due to low outside temperature and the control method used, the water temperature in the boiler rose repeatedly to 212 F (with pump


WATER
SATURATED
WITH
NITROGEN & OXYGEN
AT
ATMOSPHERIC PRESSURE
AIR BY WEIGHT
AIR BY VOLUME
NITROGEN BY WEIGHT
NITROGEN BY VOLUME
OXYGEN BY WEIGHT
OXYGEN BY VOLUME
PARTS PER THOUSAND BY VOLUME OR PARTS PER MILLION BY WEIGHT
29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4
32 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 212
DEGREES FAHRENHEIT

From Data in *Taschenbuch Fur Chemiker Und Physiker*, by J. D'Ans and E. Lax, second edition, 1949, pp. 968-970.

Fig. 6 — Volumes of nitrogen and oxygen dissolved in saturated water at atmospheric pressure

stopped), thereby causing release of oxygen, nitrogen, and carbon dioxide dissolved in the water at temperatures lower than 212 F.

A re-absorption of gases by the water was noted on March 4, when a 3-in. height of gases in the air chamber disappeared in one day. This disappearance undoubtedly was due to absorption by the water which was unsaturated with gas after the period when boiling temperatures were experienced.

The total gas vented during the second season was 0.3 cu ft (about 4 percent of system volume), thereby making the total gas vented during two seasons equivalent to 1.32 cu ft, or almost 20 percent of the system volume.

Attempt at Total Venting

After the end of the second heating season, it was decided to determine whether additional quantities of gas could be vented from the system. To accomplish this, the pump connection was changed so that the pump could be operated manually.

While the pump was standing still and there was only gravity circulation in the system, the burners were lighted. They burned until the control system extinguished them at a boiler water temperature of about 180 F. The pilot flames were so high, however, that they raised the water temperature to about 195 F.

At these high water temperatures, additional quantities of gas were liberated and passed from the boiler into the air chamber. When the resulting flow of gas into the air chamber ceased, the pump was started and replaced some of the high temperature water in the boiler with cooler water from the coils. After this cooler water had reduced the temperature of the water in the boiler to about 140 F, the controls lighted the burners. The pump was then stopped and the cycle repeated five times. During the six cycles, about 0.07 cu ft of gas was vented from the system.

Following the removal of these gases, the water in the experimental system, at 195 F and 17 psi, should still contain about 13 ppt by volume, or 0.09 cu ft of dissolved gases, according to the chart of Fig. 6.

Conclusions

From the results secured during the two-season operation of the experimental system, it was concluded:

1. Gases can be removed easily from a system by connecting a vent to the flow main directly above the boiler.
2. Water circulating through the system will move gases and carry them to the boiler, if the pump produces a pressure-head sufficient to force water through those parts of the system where gases are lodged.
3. It is advisable, when a system is first filled with water, to heat the water to a high temperature to remove as much as possible of the dissolved gases and of the gases which will be liberated when mineral matter, contained in the water, is heated.
4. In a well constructed system, when the gases have been removed, no more gases will enter the system other than those which are transmitted through the expansion tank.
5. In a poorly constructed system, in which leaks exist and make-up water must be supplied, the make-up water will supply additional gases to the system.
6. When pressure-heads are very low, as they generally are in gravity-circulation systems, all air traps must be vented.

APPENDIX A

Sources of Gases to be Vented

The gases which would reach the air chamber for venting could have any one or more of five sources:

1. When the system is being filled, some air may be trapped in the system.
2. The boiler feed water may contain mineral matter which, when heated, liberates gas, generally carbon dioxide.
3. The boiler feed water may contain dissolved gases, generally oxygen and nitrogen.

4. Air absorbed by the water in the expansion tank may be transferred to the system. If this happens in a closed system, the closed expansion tank will, in time, become water logged.

5. An electric current may exist in the system which releases oxygen and hydrogen from the water.

These five sources will be discussed in order:

1. It is impossible to determine accurately, or even approximately, how much air is trapped in a hot water heating system when the system is being filled with water, because that quantity varies with the design of the system and with the method of filling the system. It appears from Fig. 4 that, in this particular case, the quantity of air trapped was about 0.25 cu ft or about 3.6 percent of the volume of the system.

2. The only available water analysis was one made previously by the U.S. Geological Survey of the water at the springs where the city secures its supply. This analysis showed that the water contained 266 ppm of bicarbonates. Assuming that the tap water had the same composition, the 6.92 cu ft of water in the system contained 0.115 lb bicarbonates which, when heated, could break down and release 0.083 lb of carbon dioxide. This is equal to 0.672 cu ft at 32 F and 14.7 psia, or to 0.7 cu ft at 110 F and 16.2 psia, the average conditions of the gas in the air chamber shown in Fig. 2.

It is believed that bicarbonates begin to break down at 120 F, but the time required to complete the breakdown of all bicarbonates is unknown.

3. When water is exposed to the air, it will absorb gases from the air, especially oxygen and nitrogen.

Fig. 6 shows the quantities of air and its principal constituents — nitrogen and oxygen — expressed in *parts per thousand* (ppt) by volume, and in *parts per million* (ppm) by weight, which can be held in solution by water at various temperatures when the pressure of the air is one atmosphere.

Note that when water is saturated with nitrogen and oxygen, the resulting *air* in water contains about two parts of nitrogen to one part of oxygen, whereas the *air* in the atmosphere contains about four parts of nitrogen to one of oxygen.

The quantities shown in Fig. 6 apply to water which is free from animal and plant life. In open ponds, the plant life in the water adds oxygen to the water and the animal life removes oxygen.

The chart of Fig. A-1 shows the quantity of air, *i.e.*, nitrogen and oxygen, which can be held in solution by water at various temperatures and pressures. This chart is based on the assumption that the quantity of air in solution varies directly with the pressure of the gas.

Assuming that the tap water with which the boiler was filled was at a temperature of 80 F and under a pressure of 30 psia, and that it was saturated with air, it would contain about 34 ppt of air by volume, according to the chart of Fig. A-1. If the boiler temperature were raised from 80 F to 140 F, and its pressure were lowered from 30 psia to 20 psia, the water then could only hold about 16.5 ppt in solution and would consequently allow 17.5 parts, or about 0.12 cu ft, to vent into the air chamber. Since the tap water was probably not saturated, it seems that the air released from the water would be less than 0.1 cu ft.

4. The rate at which the air, absorbed by the water in the expansion tank, is transferred to the system, varies with the location of the expansion tank with reference to the boiler, and also with the frequency and the magnitude of the temperature variations of the water in the system.

Assuming that the water in the expansion tank was at a temperature of 75 F and a pressure of 14.7 psia, and that the water in the boiler was at a temperature of 140 F and a pressure of 17 psia, the expansion tank water could hold air at the rate of 17½ ppt and the boiler water at a rate of 14 ppt. Hence, whenever 1 cu ft of water was transferred from the expansion tank to the boiler, about 0.02 cu ft of air could be transferred. This is such a small quantity that it need not be considered in the test of the system.

5. Since the experimental system consists entirely of cast iron, wrought iron, and steel, it is not likely that sufficient electric currents exist in the system to produce an appreciable quantity of hydrogen.

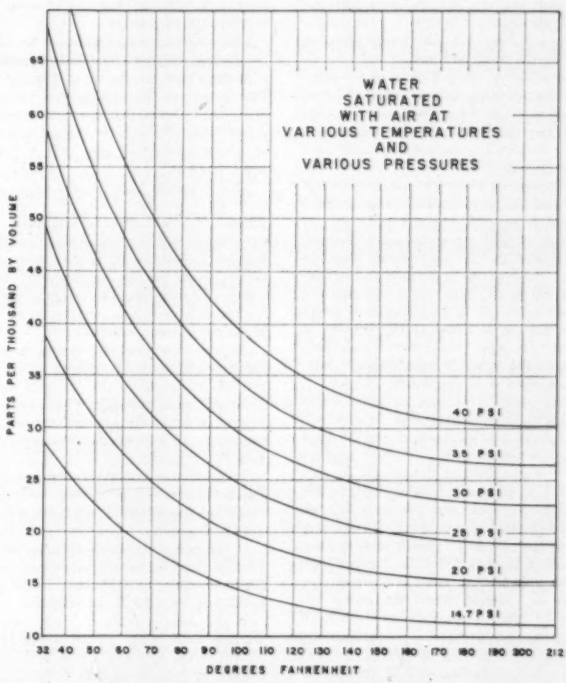
APPENDIX B

Discussion of Venting Problem

This discussion applies to a hypothetical system shown in Fig. B-1, and to an actual installation for the building shown in Fig. B-2, having roof or ceiling panels shown in Fig. B-3.

Hypothetical System

The system shown in Fig. B-1 has two circuits, A and B. The water leaving the boiler can flow through either circuit or partly through each circuit. The two circuits are practically alike, except that circuit A has no air trap, while circuit B has an air trap 6 ft high, made necessary by



From Data in *Taschenbuch Fur Chemiker Und Physiker*, by J. D'Ans and E. Lax, second edition, 1949, pp. 968-970.

Fig. A-1 — Volume of air dissolved in saturated water at various temperatures and absolute pressures

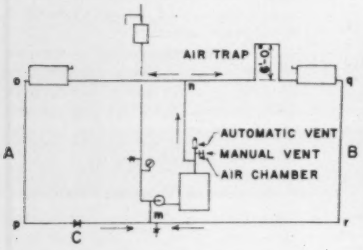


Fig. B-1 — Diagram illustrating effect of air trap in hot water system

Fig. B-2 — Research residence No. 7 at University of Texas

some obstruction in the building. Circuit A consists of sections m n and n o p m, and circuit B consists of sections m n and n q r m.

The system has an open expansion tank and an air chamber directly above the boiler where gases can be held until they escape through the automatic air vent, or until they are released by means of the manual air vent.

Both radiators are air traps and are vented in the usual manner.

If both legs of the 6-ft air trap are filled with water, the trap will not affect the flow of water through the circuit except in that it increases the friction in that circuit and thereby reduces the quantity of water flowing through it.

To determine how the system will operate, find the approximate pressure head that the pump will produce and the rate at which it will circulate water through the system. To do this, assume that the friction in section m n is equal to the friction in 30 ft of 1¼-in. pipe, and that the friction in section n o p m, as well as in section n q r m is equal to the friction in 60 ft of 1-in. pipe. Make two calculations, one when the pump is circulating 20 gpm, and one when it is circulating 10 gpm.

If the pump circulates 20 gpm, which will flow through section m n, 10 gpm will flow through section n o p m and 10 gpm through section n q r m.

When water flows at the rate of 20 gpm in a 1¼-in. pipe, the friction head is 800 milinches per foot, and the total friction head in 30 ft of pipe is 2 ft. When water flows at the rate of 10 gpm in a 1-in. pipe, the friction head is 850 milinches per foot, and the total friction head in 60 ft of pipe is 4.25 ft. Hence, when the pump circulates 20 gpm, its pressure head is 6.25 ft.

Similarly, when the pump circulates 10 gpm, the friction head in section m n will be 30 x 220 milinches, or 0.55 ft, and the friction head in each section m n o p and n q r m will be 60 x 250 milinches, or 1.25 ft, and the total friction head in the circuit will be 1.8 ft.

Neither one of these two sets of values, 20 gpm and 6.25 ft, or 10 gpm and 1.8 ft, correspond with any set of values shown in the performance chart of the pump (Fig. 3).

A third calculation could be made by assuming that the pump circulates 15 gpm, but, in this case, it is sufficiently accurate to assume that the pressure head varies uniformly with the quantity of water flowing through the system.

The two calculated values can be plotted on the performance chart and connected by a straight line as shown in Fig. 3. This line intersects the performance chart line at 17 and shows that the pump will circulate water through the system at the rate of approximately 17 gpm with a pressure head of 4.8 ft.

This pressure head would exist in the flow main at the discharge side of the pump. It would decrease gradually along the circuit as it is consumed in overcoming friction and it would become zero in the return main at the suction side of the pump. Hence, where the circuit meets the air trap, the available pressure head would probably be only about 3.2 ft.

Assume now that the system had been drained and that, in refilling it, so much air had remained in the air trap that the pressure head available there was insufficient to force the air out and that, consequently, no water could flow through circuit B.

To determine how the system would then function, proceed as before and assume that the pump would circulate either 10 gpm or 5 gpm.

If the pump circulates 10 gpm, the total friction head in the circuit would be 30 x 220 milinches, or 0.55 ft, plus 60 x 850 milinches, or 4.25 ft, or 4.80 ft.

If the pump circulates 5 gpm, the total friction head in the circuit would be 30 x 62 milinches, or 0.16 ft, plus 60 x 250 milinches, or 1.25 ft, or 1.41 ft.

Plotting these two sets of values in Fig. 3 and connecting them by a straight line, it is found that the pump would circulate water through the system at the rate of approximately 12 gpm with a pressure head of about 5.6 ft in the flow main at the discharge side of the pump, and about 3 ft 8 in. at the air trap. The water would then stand in the trap about as shown in Fig. B-4. This would be insufficient to force water through the trap.

The only recourse then would be to close the valve C, Fig. B-1, in the return main of circuit A. This would stop all circulation through the system and the pump would build up its pressure head to 7 ft according to the chart of Fig. 3, or until the head was sufficient to force the water through the trap.

The water would then carry the air from the trap to the boiler where it would be vented to the outside. After the air has thus been removed from the system, no additional air should enter the system and both circuits should continue to function until the system is drained and the air trap again partially filled with air during the filling process.

If, during the filling process, so little air is caught in the trap, Fig. B-4, that the distance from the line ST to the crown of the trap is less than one-half of 3 ft 8 in., the pressure head will be sufficient to force the water through the trap. Both circuits will begin to function when the pump is started, and, therefore, it will not be necessary to close the valve C to secure circulation in circuit B. The distance 3 ft 8 in. represents the calculated pressure head produced by the pump at the air trap.

Actual Installation

The system shown in Fig. B-3 was designed for the building shown in Fig. B-2. This building is one of several research residences erected in Austin, Tex., for studies at the University of Texas of methods of improving building construction and building sanitation.

The studies are being conducted under the direction of Prof. W. R. Woolrich, Dean of Engineering. The phase relating to heating and cooling is being conducted by Prof. W. E. Long of the Department of Mechanical Engineering.

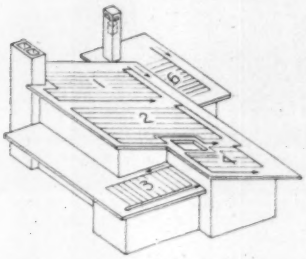


Fig. B-3 — Diagram showing location of pipe coils in research residence No. 7

The main part of the house has a sloping roof slab. One room and the garage have horizontal roof slabs. These slabs form the roof and also the ceiling of the building, except for the kitchen and the hall which have a horizontal, suspended ceiling.

The pipe coils are placed in the roof slabs so that they can be used during the winter to heat the building, and during the summer to intercept the heat which would otherwise pass through the roof and into the building.

The heating system is divided into six circuits: Nos. 1, 2 and 4 are in the sloping roof slab; No. 3 is in the horizontal roof slab; No. 5 is in the suspended ceiling; and No. 6 is in the garage roof slab.

The six circuits have a common supply line, but each has its separate return line. Every circuit has a gate valve and a thermometer in its return main so that, if the several circuits are not well balanced, corresponding adjustments can be made. The circuits were so designed that each will have approximately the same friction head when it receives its proper share of the heated or cooled water.

The system has no vent except the one above the boiler, such as is shown in Fig. B-1. An open expansion tank is used and is located 3 ft above the highest pipe coil. Although the heat distribution seemed proper as judged by touch before the pipes were covered by cement, Professor Long noticed that, when the building was completed, the room under circuit 2 was not being heated as well as the other rooms. He concluded that this circuit was partially or totally air-bound, and, therefore, closed the valves in the return main of every circuit, except that of No. 2, so that all water circulated by the pump had to flow through this circuit. The result was that the air which had been trapped in circuit No. 2 was pumped into the boiler and vented from there out of the system. All valves were then opened and all circuits operated properly during the entire heating season.

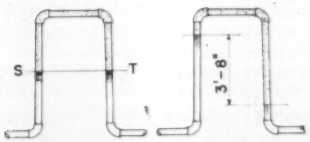


Fig. B-4 — Effect of pump on position of air in trap

APPENDIX C

Absorption of Air from Expansion Tank

The transfer of air from the expansion tank to the heating system, and, especially, to the higher radiators of the system, has an important bearing on the venting of hot water heating systems.

This transfer of air can be explained as follows. Let Fig. C-1 represent a section of a hot water heating system which has a closed expansion tank and has either gravity or forced circulation. Assume that the volume of the system will be 120 cu ft, that the volume of the expansion tank will be 20 cu ft, and that the expansion tank contains one-half water and one-half air.

Assume that at some time during the operation of the heating system the water in the highest radiators is at a temperature of 180 F and at a pressure of 34.7 psi, and that the water in the expansion tank is at a temperature of 120 F and at a pressure of 52.6 psi.

Assume next that the water in the system cools from 180 F to 140 F. During this reduction in temperature, the 120 cu ft of water in the system will shrink to 118.4 cu ft, and 1.6 cu ft of water will flow out of the expansion tank into the flow riser. From there, it will be circulated into the several radiators beginning with those on the highest floor.

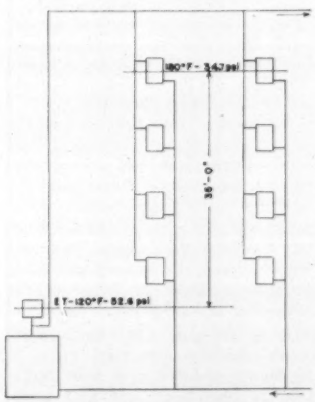


Fig. C-1 — Diagram of 4-story hot water system with closed expansion tank

Assume that the water in the expansion tank was saturated with air. In that case, it contained about 45 ppt of air (Fig. A-1). When this water arrives in the upper radiators, where its temperature is raised from 120 F to 140 F, and its pressure is lowered from 52.6 psi to 34.7 psi, it can hold only about 30 ppt of air in solution (Fig. A-1) and will, therefore, release about 15 ppt of air. Hence, for every cubic foot of water which flows out of the expansion tank into the system, about 0.009 cu ft of air is transferred from the expansion tank to the system.

This calculation is crude, but it should explain why air leaves the expansion tank and why it lodges primarily in the radiators in which the pressure is lowest, namely in those on the upper floor of the building.

WALSH & CO. NAMED SERVEL DISTRIBUTOR

Appointment of J. A. Walsh & Co. of Houston as distributor for Servel air conditioning equipment in 35 Texas counties was announced recently.

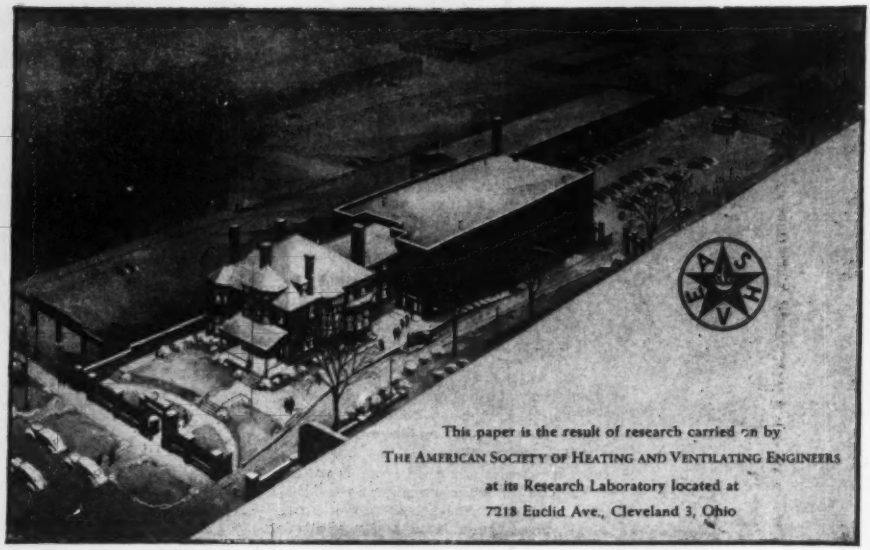
James A. Walsh, a member of the Society, is president of Walsh & Co. He joined the firm in 1937, when it was under the name Air Conditioning Co., and has headed it since 1939.

The Walsh organization recently moved into a completely new office building and warehouse in Houston. The building was formally opened with special ceremonies on September 20.

INSTALL NEW GAMA OFFICERS

New officers of the *Gas Appliance Manufacturers Association* were installed in office at a special meeting of the board of directors in St. Louis, October 14.

Louis Ruthenburg, chairman of the board of Servel, Inc., was installed as president, replacing F. O. Hess, president of Selas Corporation of America. A. B. Ritzenthaler, vice president of the Tappan Stove Co., moved up to become first vice president and J. F. Donnelly, marketing director of A. O. Smith Corp., became second vice president. L. C. Harvey, president of Affiliated Gas Equipment, Inc., retained his position as treasurer, and H. L. Whitelaw remained as managing director and secretary.


This paper is the result of research carried on by
THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS
at its Research Laboratory located at
7218 Euclid Ave., Cleveland 3, Ohio

Radiant Energy Emission of Atmosphere and Ground

A Design Factor in Heat Gain and Heat Loss

By George V. Parmelee* and Warren W. Aubele**, Cleveland, Ohio

SUMMARY — This paper discusses the nature, magnitude, and significance of the low-temperature long-wave-length radiation received by building surfaces from the atmosphere, the ground and other building surfaces. Observations made with a special radiometer are given and are compared with similar data from the field of meteorology. The radiometer is described briefly. Experimentally determined heat flow data on sunlit glass show that the net radiant energy exchange between a building surface and its outdoor environment, exclusive of solar radiation incident upon the surface, is of the same order of magnitude as the convective exchanges. The radiant exchange cannot be treated by use of an equivalent surface conductance, but can be dealt with by a modification of the well-known sol-air temperature concept.

Examples show that on a quiet cloudless night, a well insulated flat roof loses 35 percent more heat than when the sky is overcast, 25 percent more than when it is windy and overcast, and 15 percent more than when it is windy and clear. The effect on vertical surfaces is smaller. It is shown that the heat flow through a sunlit roof calculated without regard to radiant energy exchange will be about 40 percent too high for a 24-hour period.

THROUGHOUT the day and night the exterior surface of a building continuously emits radiation which, in this paper, will be termed low-temperature, long-wave-length radiation. At the same time, it receives low-temperature, long-wave-length radiation from other buildings, from the ground and from the atmosphere. During the hours of day-light, the building surface also receives solar radiation, part coming directly from the sun, and the balance, diffusely from the sky, the ground and other building surfaces by virtue of the scattering and reflection of the direct rays of the sun. In recent years, much attention has been given to evaluating the effect of solar radiation on heat losses and heat gains. The purpose of this paper is to evaluate the significance of the effect of net exchange of low-temperature radiation between the exterior surface of a building section and its surroundings on the heat flow through the building section. The radiant energy emitted by a building surface is a function of its emissivity and its temperature. The radiant energy emitted by the outdoor surroundings, on the other hand, is dependent on the water vapor and carbon dioxide content and temperature of the atmosphere and the degree of cloudiness, as well as on the temperature

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**Research Engineer, ASHVE Research Laboratory.

For presentation at the 58th Annual Meeting of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, St. Louis, Mo., January 1952.

and emissivity of the ground and other building surfaces seen by the surface under consideration.

Presently used U values (overall coefficients of heat transfer) for building sections are based upon two assumptions: one, that the convective and radiation effects are additive and may be combined into a single outdoor film coefficient, and two, that the outdoor surface is in low-temperature radiant energy exchange with a black body radiator which is at the temperature of the outdoor air. Similar assumptions are usually made in calculating sol-air temperatures, though the low-temperature radiation effects often are ignored.

It will be shown in this paper that the *net exchange* of low-temperature radiation is not necessarily in the same direction as the convective exchange between a building surface and the ambient outdoor air. It will also be shown that the outdoor surroundings by no means radiate as a black body at air temperature. These facts require that the present concept of U values and sol-air temperatures be re-examined. The authors have discussed this subject briefly in earlier research papers, but are only now able to present a more complete discussion of the problem.

In this paper, the radiation phenomenon is described in terms of the radiation emitted by the outdoor surroundings and that emitted by a building surface, rather than in terms of the net exchange. For example, under certain conditions, a building surface may receive from the outdoor surroundings 130 Btu per (hr) (sq ft), a quantity comparable in magnitude to solar radiation intensities. If this surface has an emissivity of 1.0 and is at a temperature of 130 F, as might be the case for a roof heated by the sun, it emits 211 Btu per (hr) (sq ft). The net exchange, of course, is 81 Btu per (hr) (sq ft).

By way of background, the radiant energy emission characteristics of the several elements involved in radiation exchanges are described in a general way in the following sections.

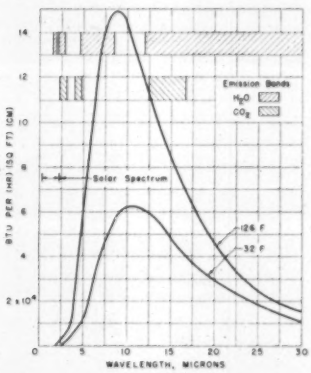


Fig. 1 — Spectral energy distribution of black body radiators and approximate locations of emission bands of water vapor and carbon dioxide

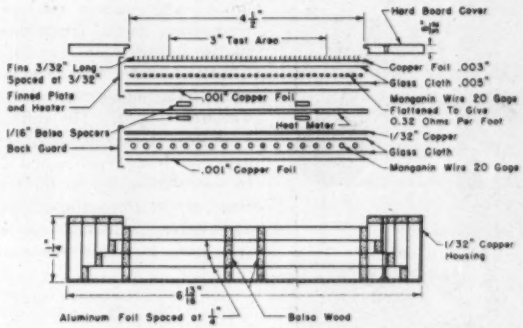


Fig. 2 — Exploded view of convection-compensated radiometer

Radiant Energy Emission

The radiant energy emitted by a black body through a hemispherical envelope is given by the Stefan-Boltzmann equation thus:

$$(q/a) = \sigma T_a^4 \text{ Btu per (hr) (sq ft)} \quad \ldots\ldots\ldots\ldots (1)$$

where

σ = the Stefan-Boltzmann constant, 0.173×10^{-8} Btu per (hour) (square foot) (Fahrenheit degree absolute to the fourth power)

T_a = the temperature of the black body, Fahrenheit degrees absolute

Fig. 1 shows the spectral distribution of black body radiation at temperature levels encountered in air conditioning. Note the boundaries of the solar spectrum. Equation 1 gives the total area under these curves. For example, the radiant energy emitted by a black body at 32 F is 102 Btu per (hr) (sq ft).

The energy emitted by non-black surfaces, such as the ground and building surfaces, is given thus:

$$(q/a) = \epsilon\sigma T_a^4 \text{ Btu per (hr) (sq ft)} \quad \ldots\ldots\ldots\ldots (2)$$

where

ϵ = the average spectral emissivity of the surface at temperature, T_a.

The energy distribution of non-black radiators can be found by multiplying each ordinate of the spectral curve for a black radiator by the value of ϵ for that particular wave length.

Emission and Absorption of the Atmosphere

The radiating constituents of the cloudless atmosphere, principally water vapor and carbon dioxide, emit in spectral bands as shown in Fig. 1. The cross-hatched areas show the regions of strongest emission (or absorption). The intensity of the radiation emitted at any wave length is dependent upon the partial pressure of the constituent, its temperature and its thickness. Since the first two factors vary with elevation above the ground, the energy received at ground level is the sum of that emitted by the lowest layer of the atmosphere plus the radiation transmitted by this layer incident from layers at greater altitudes. If the temperature and moisture distribution in the atmosphere are known, the radiant energy from the sky can be calculated by a graphical method

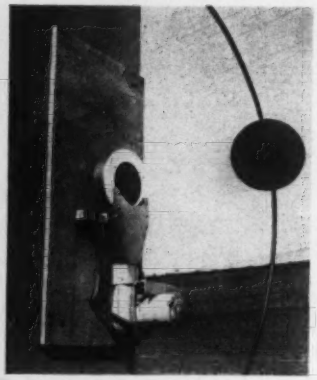


Fig. 3 — View of ASHVE convection-compensated radiometer mounted on panel of solar calorimeter

devised by Elsasser[1], who has summarized the work in this field over the past half century.

Both common experience and scientific investigation show the influence of clouds on the loss of heat by radiation from the earth. Whereas frost may form on a clear still night with temperatures as high as 40 F due to radiative cooling of the ground and adjacent air layers, clouds will effectively reduce this heat loss and prevent frost.

Ground and its Surroundings

While values of radiation received by horizontal surfaces will suffice for use in meteorology, heating and cooling load estimates will require data on radiation received by surfaces which see both the sky and the ground. At night, the ground surface may be cooled below air temperature; during the day, it may be warmed by the sun.

The surface temperatures of buildings are likewise affected by the weather and also by internal heat sources and sinks, so that the radiant energy from ground and buildings will vary widely throughout the day.

Observations of Radiation from Outdoor Surroundings

The influence of low temperature radiant energy from the sky and ground surroundings received early recognition as an important factor in the investigations carried on at Cleveland under the Technical Advisory Committee on Heat Flow Through Glass†. The difficulty of evaluating this component of heat exchange from experimental data, or by calculation, led to the construction of a convection-compensated radiometer. Although no attempt was made to secure systematic and continuous observations, sufficient data have been collected under different conditions to be of practical use.

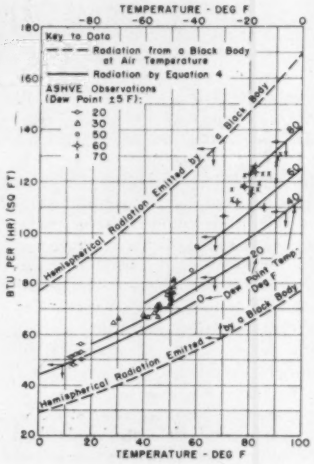


Fig. 4 — ASHVE observations of low temperature radiation received by a horizontal surface on cloudless days compared with Equation 4

ASHVE Convection Compensated Radiometer

An exploded view of the ASHVE radiometer is shown in Fig. 2. The surface is a finned plate which is heated by a resistance wire continuous over the entire diameter to provide edge guarding. The temperature of the central or working area is measured by thermocouples. By making two successive observations with two different heat inputs, the convection loss can be eliminated by simultaneous equations and the incident radiation determined by the usual heat balance equation (See Appendix A). The back heat flow is minimized by a second heater. Actual back heat flow is measured by the heat meter. To reduce the influence of varying wind velocity, the instrument is provided with a small blower to force a jet of air parallel to the plane of the surface. The radiometer is usually shielded from the direct sun. The incident diffuse solar radiation is measured by an Eppley pyrheliometer and deducted from the measured total incident short-wave-length and long-wave-length radiation.

Fig. 3 is a closeup of the radiometer and shows the blower and sun shield. The instrument is mounted on the panel of the calorimeter used to measure heat flow through glass.

Horizontal Surfaces

Fig. 4 presents observed values of long-wave-length radiant energy emitted during daylight hours by cloudless skies to a horizontal surface, plotted against simultaneously recorded air temperatures. The incident solar radiation intensities, also recorded simultaneously, are

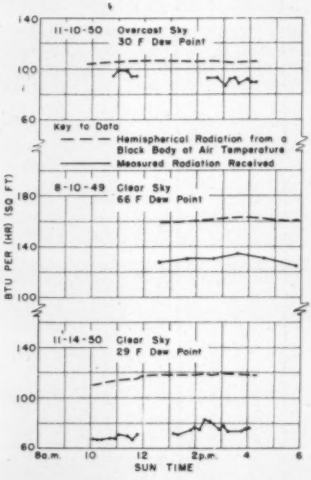


Fig. 5 — Typical observations of low temperature radiation received by a horizontal surface

[1]Exponent numerals refer to References.

†Personnel: R. A. Miller, *chairman*, A. B. Algren, W. J. Arner, A. H. Baker, F. L. Bishop, E. W. Conover, W. B. Ewing, J. E. Frazier, J. S. Herbert, D. R. Muir, F. W. Preston, C. A. Richardson, Vic Sanders, H. B. Vincent, J. R. Young.

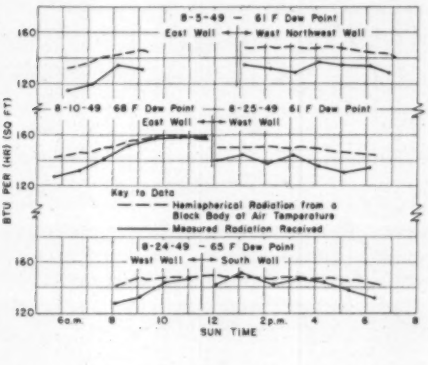

8-5-49 — 61 F Dew Point
East Wall — West Northwest Wall
8-10-49 68 F Dew Point — 8-25-49 61 F Dew Point
East Wall — West Wall
Key to Data
Hemispherical Radiation from a Black Body at Air Temperature
Measured Radiation Received
8-24-49 — 65 F Dew Point
West Wall — South Wall
BTU PER (HR) (SQ FT)
SUN TIME

Fig. 6 — Typical observations of low temperature radiation received by vertical surfaces from a clear sky and ground surroundings

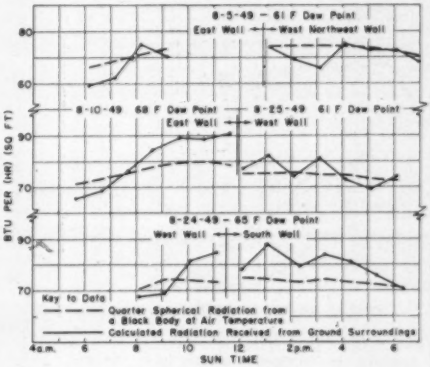

8-5-49 — 61 F Dew Point
East Wall — West Northwest Wall
8-10-49 68 F Dew Point — 8-25-49 61 F Dew Point
East Wall — West Wall
8-24-49 — 65 F Dew Point
West Wall — South Wall
Key to Data
Quarter Spherical Radiation from a Black Body at Air Temperature
Calculated Radiation Received from Ground Surroundings
BTU PER (HR) (SQ FT)
SUN TIME

Fig. 7 — Calculated radiation received from the ground surroundings by a vertical surface, compared with black body radiation

not included in the plotted quantities. Fig. 5 shows several series of observations as a function of time.

The dotted curves of Fig. 4 show the total hemispherical radiation emitted by a black body as a function of temperature. The intersection of a horizontal line drawn through any one of the test points with the black body curve gives the equivalent radiating temperature of the cloudless atmosphere. Within the limits of the data presented, this ranges from about —55 F to +65 F. The values are a function of dry bulb temperature. No particular difference between night-time and day-time values was observed.

Fig. 4 also compares the ASHVE observations with Brunt's[2] analysis of the observations of W. H. Dines and L. H. G. Dines[3] made in England. Brunt has correlated the data of other observers. The Dines' values, however, appear to be a better basis of comparison in that they are monthly means of systematic observations extending over a period of about six years. Brunt shows[2,4] that these and other observations of radiation emitted by the cloudless atmosphere can be correlated with dew-point temperature by an empirical equation of the following form:

$$R = R_{bo}(a + b\sqrt{P_w}) \quad \text{----------(3)}$$

where

R = radiation received by a surface from the sky, Btu per (hour) (square foot)

R_{bo} = radiation received from a black body at air temperature, Btu per (hour) (square foot); (represented by the dotted line curves of Fig. 4)

a, b = constants

P_w = water vapor pressure at ground level, inches mercury

With constants a and b as determined by Brunt from the Dines' data, the radiation received by a horizontal surface, R_h, is:

$$R_h = R_{bo}(0.55 + 0.33\sqrt{P_w}) \quad \text{---------(4)}$$

Elsasser[5] lists constants for observations made in different parts of the world. The average values, including the Dines' constants are 0.50 and 0.34 respectively for constants a and b in Equation 3.

Plots of Equation 4 are shown in Fig. 4 as solid curves for different dew points. The exact limits of temperature in the Dines' observations are not known, but the solid curves probably are extrapolations in part. The ASHVE data have been grouped in 10-deg intervals of dew point, to facilitate comparison. Agreement is rather good since the temperature and moisture distributions in the atmosphere are only approximately defined by the ground level dry bulb and dew point temperatures. Though the correlation developed by Brunt has some limitations (see Elsasser[6]), Equation 4 appears to be useful as a working formula.

It is convenient to express the radiation received by a horizontal surface from a clear sky as a fraction of black body radiation at air temperature, that is, R_h/R_{bo}. This fraction varies only with dew point, according to Equation 4. The radiation may also be expressed as the difference, ΔR, between black body radiation at air temperature, and R. For horizontal surfaces,

$$\Delta R_h = R_{bo} - R_h = [1 - (R_h/R_{bo})]\ [\sigma T_a^4] \quad \text{....(5)}$$

where

T_a = outdoor air temperature, Fahrenheit degrees absolute

From the values given in Fig. 5, it can be shown that R_h/R_{bo} is about 0.60 for a dew point of 29 F and from 0.75 to 0.84 on a day when the dew point was 66 F.

Effect of Clouds

Included in Fig. 5 are observations made when there was occasional light snowfall from a sky overcast with clouds sufficiently thin to permit determination of the sun's position. The fraction R_h/R_{bo} varied from about 0.84 to 0.94. On other days, with overcast skies, the sur-

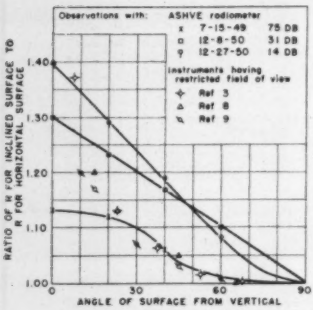


Fig. 8 — Ratio of low temperature radiation received by inclined surfaces on clear days to that received by a horizontal surface

roundings were to all practical purposes a black body radiator. Radiation from completely overcast skies as measured by Dines[3] averaged about 96 percent of black body radiation.

On hazy days there seemed to be a general tendency for radiation values to run somewhat higher than would be indicated by Equation 4. Observations of the sky through polarized glass on such days usually indicated the presence of formless clouds, sometimes referred to as fumulus. It is likely that these increased the values over clear sky radiation. Cirrus clouds, though extremely high and thin, also appeared to raise the radiation above clear sky values.

A discussion of radiation received from partially overcast skies is valueless here because of the extreme variability. Some investigators, however, have found a correlation between cloud height and radiation received on completely overcast days.

Inversions

The condition known as an inversion is, in part, the result of rather intense cooling of the ground and adjacent air layers by radiation to the sky during the night. This is promoted by an absence of vertical air movement, with the result that the air aloft is warmer than at the ground. One would expect, therefore, that the atmosphere would emit more radiation under such conditions than if a normal temperature gradient existed. This was confirmed by Wexler[7]. It is unlikely that the Brunt empirical equation applies to radiation received from the atmosphere during inversions, since most of the Dines' observations were made during the day.

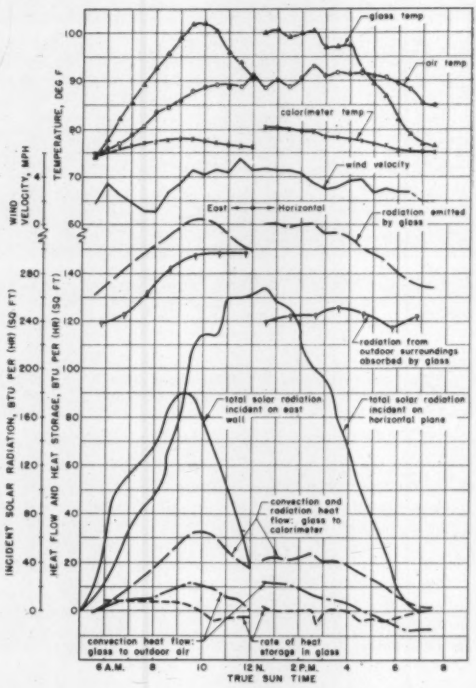


Fig. 9 — Solar irradiation, temperatures, heat storage rates and rates of heat exchange between glass and its environment: Glass No. 21, East and horizontal orientations, August 10, 1949

Vertical Surfaces

Radiation received by vertical surfaces is illustrated by Fig. 6. Note that early in the morning and late in the afternoon the surroundings (sky and ground) emit considerably less radiation than a black body at air temperature, while they emit as much or more near noon. This is attributed to solar heating during the day and radiative cooling near sunrise and sunset.

The radiant energy received by a vertical surface from a clear atmosphere can be found through data obtained by W. H. and L. H. G. Dines[3]. The viewing field of their instrument was restricted to a cone angle of 15 deg, so that they made observations at 15-deg intervals from a zenith angle of 7-1/2 deg to 82-1/2 deg. Brunt determined from the Dines' data the variation with zenith angle of a and b in Equation 3. By integration it is found that the radiation received by a vertical surface from a cloudless atmosphere is:

$$R_v = R_{bb}(0.30 + 0.185\sqrt{P_w}), \quad \text{Btu per (hr)(sq ft)} \text{ ---------- (6)}$$

Subtraction of the calculated atmosphere contribution from the total long-wave-length radiation received

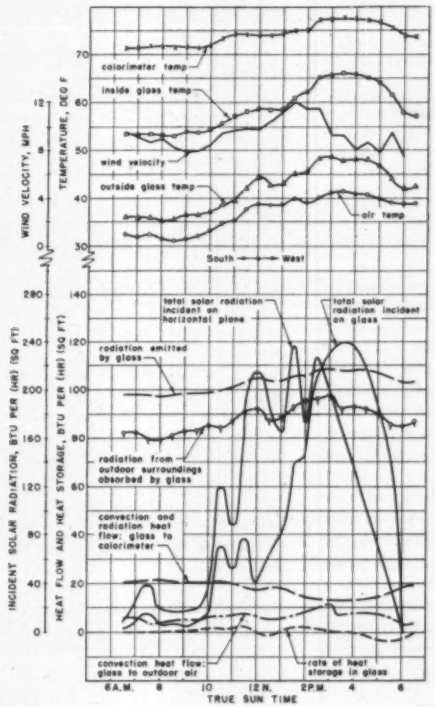


Fig. 10 — Solar irradiation, temperatures, heat storage rates and rates of heat exchange between glass and its environment: Double glass No. 9, ¼-in. air space, South and West orientations, April 9, 1948

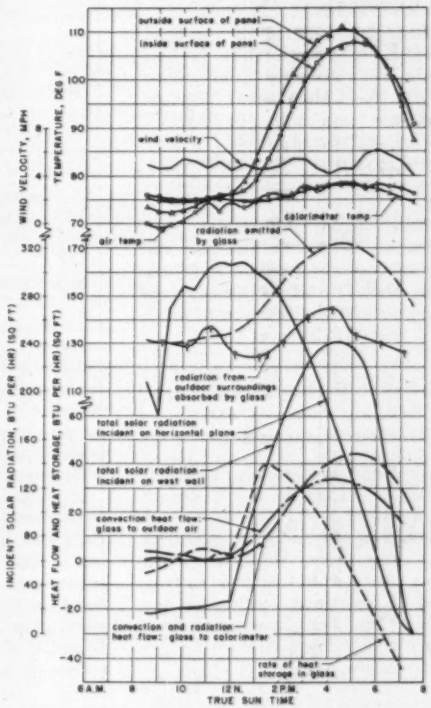


Fig. 11 — Solar irradiation, temperatures, heat storage rates and rates of heat exchange between glass and its environment: Glass block panel 12-in. type I, West orientation, June 22, 1949

by the vertical surface gives an estimate of the ground and building surface contribution. Calculations made from the data of Fig. 6 give values which are shown in Fig. 7 and compared with the quarter spherical radiation emitted by a black body at air temperature (the angle factor of a vertical surface with respect to the ground is 0.5). The results, though showing considerable scatter due to accumulated errors, follow the expected trend.

The Dines[3] made observations of radiation from a grass field during the course of their study of sky radiation. These were generally made in the afternoon and evening. Yearly averages of observations taken in the presence of overcast skies were equal to black body radiation values, while those made on clear days were slightly below.

It is apparent that the ground contribution to the radiation received by vertical surfaces can be an extremely variable quantity because of differences in ground cover, proximity of buildings and the variable sun effect on building surfaces.

Table 1 — Heat Balance on Three Roof Panels for a 24-Hour Period
Values in Btu per (day) (square foot)

Roof and Type No.	Absorbed solar radiation	Heat Flow to Room	Convection to Outdoor Air	Low-Temperature Radiation Exchange
I 2 in. concrete, black asphalt top	1610	120	970	520
II 2 in. concrete, slag top	1610	40	860	710
III 2 in. pine, slag top	1610	35	1035	540

Table 2 — Temperature, t_s, Heat Loss, $q_{c,r}$, for Outdoor Surface of Building Section

70 F *Indoor Temperature, Zero F Outdoor Air Temperature*

Surface		Roof		Wall		Any	
Radiation Source		Cloudless Sky		Cloudless Sky and Ground		Black Body at Air Temperature	
Radiation Absorbed by Surface (ϵ=0.9)		43.1		59.3		70.2	
Column		A		B		C	
C'	h_{co}	$q_{c,r}$	t_s	$q_{c,r}$	t_s	$q_{c,r}$	t_s
0.10	0.5	8.7	−17.0	7.4	−4.0	6.4	+ 5.6
0.25	0.5	19.3	− 7.0	16.5	+4.0	14.4	+12.4
0.10	4.0	7.4	− 4.5	7.2	−2.0	6.8	+ 1.4
0.25	4.0	18.0	− 2.0	17.2	+1.2	16.6	+ 3.6

Inclined Surfaces

Radiation received by inclined surfaces is of importance in heat exchange calculations for roofs. Fig. 8 shows observations, made on cloudless days with the ASHVE radiometer, plotted as ratios of radiation received by the inclined surface to that received by the horizontal.

Yearly means of the Dines'[7], observations of Brooks, Lorenzen and Boelter[8], and of Ramdas, et al[9] are also plotted. All of these values were obtained by instruments which had restricted fields of view.

Radiation Exchange Between Building Surfaces and Outdoor Surroundings

Heat flow by convection and radiation to or from the indoor surface of a wall or roof is the resultant of convective and radiative exchanges and solar energy absorption which take place at the outdoor surface, and of heat storage within the section. This heat balance, in time-rates of heat flow or heat storage per unit surface area, is:

Heat flow by convective and radiative exchanges at the indoor surface = Absorbed solar radiation ± Radiative exchange between outdoor surface and outdoor surroundings ± Convective exchange between outdoor surfaces and outdoor air ± Heat storage within the section .....(7)

Expressed in symbols, Equation 7 becomes:

$$(q/a)_{c,r} = \alpha_s I - \epsilon(\sigma T_s^4 - R) - h_{co}(t_s - t_o) - S, \quad \text{Btu per (hr) (sq ft)} \quad .....(8)$$

where

α_s = absorptance of surface for solar radiation, dimensionless

ϵ = emissivity of surface at temperature, t_s, dimensionless

σ = the Stefan-Boltzmann constant, 0.173×10^{-8} Btu per (hour) (square foot) Fahrenheit degree absolute to the fourth power)

h_{co} = outdoor convection conductance, Btu per (hour) (square foot) (Fahrenheit degree)

I = total incident solar radiation, Btu per (hour) (square foot)

R = low-temperature radiation received from outdoor surroundings, Btu per (hour) (square foot)

S = rate of heat storage in section, Btu per (hour) (square foot)

t_s = temperature of outdoor surface of section, Fahrenheit degrees

t_o = temperature of outdoor air, Fahrenheit degrees

T_s = temperature of outdoor surface of section, Fahrenheit degrees, absolute

Sunlit Glass

It is convenient to consider the total rate of heat flow through glass as being composed of two components: (1), that due to transmitted solar radiation, and (2) that due to convection and radiation from the indoor surface. The first component has been the subject of other research papers[10,11,12,13] and will not be discussed here.

The effect of the exchange of low-temperature radiation between the glass and its surroundings on the rate of heat flow by convection and radiation to or from the indoors is dependent upon the magnitude of the other terms in Equation 8. Figs. 9, 10 and 11 give experimental determinations of these terms and pertinent temperature, wind, and solar radiation data for three types of glass of different absorptivities and heat capacities. The figures give curves of $\sigma\epsilon T^4$, radiation emitted by the outdoor glass surface, and ϵR, low-temperature radiation from outdoor surroundings absorbed by this surface. The net radiation exchange, therefore, equals the difference between these two curves. In the tests shown in Fig. 9 and 11, R was measured with the radiometer. For Fig. 10, R was computed by means of Equation 8, since the necessary data, including α_s were known. ϵ was taken as 0.938. The term $(q/a)_{c,r}$ was computed from measured temperatures by methods previously described.[14] The term h_{co} was evaluated from independent experimental determinations. S was computed from heat capacity data and the temperature curves.

In Fig. 9, for a sheet of patterned glass,[13] the data for the morning run show that the loss in the radiation exchange was nearly constant until near noon and that it was about twice the convective heat loss. In the afternoon, the net exchange was of considerably greater magnitude, amounting to as much as 40 Btu per (hr) (sq ft), because the glass saw only the sky. Of interest is the intersection of glass and air temperature curves at about 4:45 p.m. At this point, the absorbed solar energy (about 35 percent of the total incident solar radiation) appeared only as convection and radiation gain by the calorimeter and as radiation loss to the sky. Note that, before this time, a higher wind velocity would have *decreased* heat gain, but after this hour it would have *increased* the heat gain.

Fig. 10 plotted from test data on two sheets of flat glass[11] (sample No. 9) spaced at ¼ in., shows that the radiation loss was from 2 to 3 times as great as the convection loss.

In Fig. 11, it is seen that the radiation loss in the morning was practically zero, whereas in the afternoon it was about the same as the convection loss. The block in this panel is 12 in., Type I.[12]

These data show: (1) that radiation exchange is significant as compared with convective exchanges; (2) that it is not directly related to the convective exchange; and (3) it may be opposite in sign to the convective exchange.

Sunlit Roofs

The significance of low-temperature radiation exchange as a means of dissipating solar energy absorbed by sunlit roofs can be demonstrated by calculations based upon test data on roof panels[15] reported in 1940. The results of hourly heat balances computed for three roof sections and summed for a 24-hour period are given in Table 1. In making these calculations, it was assumed that 90 percent of the incident solar radia-

tion was absorbed by each roof panel. The net heat storage for the 24-hour period was zero. The convection coefficients selected included both wind and natural convection effects.

The low temperature radiation exchange, that is, $\epsilon\ (\sigma T_s^4 - R)$ from Equation 8, equals the absorbed solar radiation minus the heat flow to the room minus the heat flow by convection to the outdoor air. The values of radiation exchange given in Table 1 must be regarded as approximations, since they include all of the errors attendant upon the assumptions necessary to the calculations, as well as experimental errors. The low temperature radiation exchange computed for clear sky conditions by means of Equation 4 would be of the order of 950 Btu per (day) (sq ft). Since Weather Bureau and solar data show that the sky varied from clear to 0.9 cloud coverage (probably high thin cirrus), the roof losses must have been somewhat less than this amount. These calculations indicate that the radiation exchanges given in Table 1 are of the right order of magnitude.

Considerable error results if calculations are made with the assumption that the clear atmosphere radiates as a black body at air temperature. The low-temperature radiation exchange so computed for a 24-hour period would amount to about 250 Btu per (day) (sq ft). Moreover, such calculations give substantially zero heat loss from the roofs between the hours of 9 p.m. to sunrise, because, in this period, the roof temperatures were very nearly equal to the air temperature. Actually, during this period, the roof sections were found to be losing heat by radiation at the rate of 5 to 20 Btu per (hr) (sq ft). It is apparent therefore, that when heat flow calculations are made, the radiation exchange with the outdoor surroundings is a significant boundary condition that must be properly evaluated.

Steady State Heat Loss

Steady state and an absence of solar effects are conditions commonly used as a basis for heat loss calculations. Equation 9, a modification of Equation 8 in which $(q/a)_{csr}$ is replaced by $C'(t_i - t_s)$, may be used to illustrate the role of radiation exchange in such calculations. C' is the conductance of the building section, Btu per (hr) (sq ft) (F deg) from room temperature, t_i, to the outdoor *surface* temperature, t_s.

$$C'\ (t_i - t_s) = \epsilon\ (\sigma\ T_s^4 - R) + h_{co}\ (t_s - t_o) \quad \ldots\ldots\ldots (9)$$

The results of graphical solutions for t_s and the heat loss, $C'\ (t_i - t_s)$, for various conditions appear in Table 2 for 70 F indoor temperature and zero F outdoor temperature. Column A gives surface temperature and heat flow data for roofs which see only a cloudless sky. Column B gives similar data for a vertical surface which sees a cloudless sky and also the ground which, in this example, is assumed to radiate as a black body at air temperature. The data shown in column C apply to any surface which is irradiated by surroundings which radiate as a black body at air temperature. This is the usual condition assumed in heat loss calculations and, as indicated earlier in this paper, closely applies when the sky is overcast. The convection conductance of 0.5 Btu per (hr) (sq ft) (F deg) is applicable to still nights, which frequently occur when the sky is clear, while the value of 4.0 is applicable to fairly windy weather.

It may be seen from a comparison of values in Columns A and C of Table 2 that when the convection conductance is 0.5 and the sky is cloudless, the heat loss from a roof is about 35 percent greater than when surroundings radiate as a black body at air temperature $[(8.7 - 6.4)/6.4] \times 100$. Under the same conditions, the loss from a wall is about 15 percent greater. These percentages are of the order of about 5 percent when the convection is 4.0. It should be noted that the outdoor surface temperature is well below that of the ambient air when the sky is clear and the air calm, particularly when the building section is well insulated. It will be noted that on clear nights, an *increase* in the convection conductance actually *decreases* heat loss if the section is well insulated.

Examples for glass sections have been given in a recent research paper.[16]

Similar calculations for a 40 F outdoor temperature indicate that the difference between heat losses when the sky is clear and when it is overcast is approximately constant regardless of the indoor-outdoor temperature differential. It is assumed that the convection conductance is the same in both cases. For example, for a roof with $C' = 0.10$ and h_{co} equal to 0.5, the heat-loss $q_{c,r}$ is 4.8 Btu per (hr) (sq ft) if the sky is cloudless and 2.8 if the sky is overcast. The difference of 2.0 is within 15 percent of the difference between 8.7 and 6.4, which are values from Table 2 for zero outdoor air temperature.

The influence of radiation on heat loss just illustrated appears to have some verification in field experience. Pollock[17], in describing the results of research in a residence in California, stated that at night the temperatures of the outdoor surfaces of walls and roofs were observed to fall as much as 3 and 13 deg respectively below the outdoor air temperature.

It was also found that the Btu loss per hour per degree difference between indoor and outdoor temperatures varied widely, and that, for any given temperature differential between indoors and outdoors of 15 deg or more, there was a nearly constant difference between the maximum and minimum heat requirements. This constant difference appeared to be influenced by something other than the temperature differential between indoors and outdoors and was attributed to differences in radiation losses. Some verification of this was found in a fairly good correlation between cloudiness and hourly heat loss per degree of temperature difference.

Radiation Exchange in Design Calculations

Equivalent Surface Conductance for Radiation

The possibility of handling radiation exchange by an equivalent sur-

face conductance, h_r, based on surface-to-air temperature difference merits consideration. This conductance, added directly to the convection conductance, h_{co}, gives a combined conductance $h_{c,r}$ as follows:

$$h_{c,r} = h_{co} + h_r = h_{co} + [\epsilon_s (\sigma T_s^4 - R)/(t_s - t_o)] \quad \ldots\ldots\ldots\ldots\ldots\ldots (10)$$

The equivalent radiation conductance can be calculated from data given in Figs. 9, 10 and 11. For example, in Fig. 9 at 8 a.m., the glass temperature is 92.5 F and the air temperature is 83.5 F, giving a surface-to-air temperature difference of 9.0 deg. At the same hour, the radiant energy emitted by the glass is 151.5 Btu per (hr) (sq ft) and that which is absorbed by the glass from the atmosphere (exclusive of solar radiation) is 136.0, giving a loss of 15.5 in the exchanges. Then, h_r equals 15.5/9.0 or 1.72 Btu per (hr) (sq ft) (F deg). In Fig. 9 the average value of h_r for the morning run is 1.75 Btu per (hr) (sq ft) (F deg). For the afternoon period, the average is 4.95 up to 4 p.m., infinity at 4:45 p.m., and negative thereafter. For the test illustrated by Fig. 8, the average value was 3.20. For the test data shown in Fig. 9, it was practically zero in the morning and about 1.30 in the afternoon.

It is apparent that the value is extremely variable, and that it may be negative as well as positive. Moreover, it can be evaluated only with previous knowledge of the building surface temperature. Therefore, some serious difficulties are encountered in attempting to combine a radiation conductance with convection conductance.

Sol-Air Temperature

The computation of periodic heat flow through a wall or roof subject to diurnal variations in air temperature and solar radiation is considerably simplified when all radiation effects are combined with the air temperature in a modified form of the sol-air temperature.[18] This temperature is:

$$t_e' = ([\alpha I + \epsilon_s (R - \sigma T_o^4)]/h_{co}) + t_o \quad \ldots\ldots\ldots\ldots\ldots (11)$$

And the instantaneous rate of heat entry into the weather surface of a building section becomes:

$$q/A = h_{co} (t_e' - t_s) \text{ Btu per (hr) (sq ft)} \quad \ldots\ldots\ldots (12)$$

Unfortunately, the surface temperature, t_s, is not known, so that Equation 11 cannot be evaluated directly. This can be overcome by the following method:

Fig. 2 shows that, for horizontal surfaces, the difference ΔR_h between the black body radiation curve and any one of the dotted curves representing R, is approximately constant over the usual variation in diurnal air temperature. If a radiation coefficient, h_r', involving the air and surface temperatures be defined as follows:

$$h_r' = [\epsilon_s \sigma (T_s^4 - T_o^4)]/(t_s - t_o) \quad \ldots\ldots\ldots\ldots\ldots (13)$$

A second modification of the sol-air temperature then is:

$$t_e'' = [(\alpha I - \epsilon \Delta R)/(h_{co} + h_r')] + t_o \quad \ldots\ldots (14)$$

The corresponding instantaneous rate of heat entry into the weather surface of a building section is:

$$q/A = (h_{co} + h_r') (t_e'' - t_s) \text{ Btu per (hr) (sq ft)} \quad \ldots\ldots (15)$$

This method of handling radiation exchange was used by Alford, Ryan and Urban.[19] It is suggested that a value of h_r' be selected corresponding to the period when the surface temperature is near the maximum. The data given in Fig. 4 for vertical surfaces show that ΔR_V is of the order of 15 Btu per (hr) (sq ft) except near noon. This value will vary with the character of the surroundings.

The influence of ΔR on periodic heat flow through a roof can now be examined without recourse to analysis of experimental data as was done in a previous section. From THE GUIDE 1951, p. 273, the sol-air temperature for a horizontal roof in a clear atmosphere for a 24-hour period is 109.1 F. This was based upon $\alpha/h_{co} = 1/4$. For a 60 F dew point and about 80 F 24-hour average dry bulb temperature, ΔR = 40 Btu per (hr) (sq ft). If α be taken as 1.0, $h_{co} + h_r'$ as 4.0 and ϵ as 0.90, the modified sol-air temperature, t_e'', is 100.1 F. If the indoor air temperature is maintained at 78 F throughout the period, the heat gain will be only 70 percent of that calculated by use of the 109.1 F sol-air temperature.

If U, the overall coefficient of heat transmission, is based upon $h_{co} + h_r'$ and the appropriate indoor surface conductance, the modified sol-air temperature defined by equation 14 can be used to calculate heat flow through thin sheet material of little or no heat capacity. In this case, $q_{c,r} = U (t_e'' - t_i)$. In steady state heat flow calculations, t_e'' can also be used in the same way by omitting αI.

It should be noted that while at night αI is zero, ΔR is zero only when the outdoor surroundings radiate as a black body at air temperature. It has been shown that this is approximately true for any surface when the sky is completely overcast. Only under this condition does the usual calculation, $U (t_o - t_i)$ equal $U (t_e'' - t_i)$. Under other conditions ΔR may be positive or negative so that ordinarily $U (t_o - t_i)$ does not equal $U (t_e'' - t_i)$.

Conclusions

1. The exchange of low temperature radiation between exterior surfaces of buildings and outdoor surroundings has been illustrated by experimental data and by examples. The significance of this exchange in heat loss and heat gain calculations, as compared with convective exchanges, varies with surface orientation, clearness of the sky, dry bulb and dew-point temperature of the air, and wind velocity.

2. This radiant exchange cannot be treated by use of an equivalent surface conductance, but can be dealt with by a modification of the well-known sol-air temperature concept.

3. Measurements which were made of low temperature radiation received from clear skies by a horizontal surface were found to be in good agreement with the following simple equation:

$$R_h = R_{bo} (0.55 + 0.33 \sqrt{P_w})$$

in which R_h is the radiation received by

the surface from the sky, Btu per (hr) (sq ft), R_{bo} is the radiation that would be received from a black body at air temperature, Btu per (hr) (sq ft) and P_w equals the water vapor pressure at ground level, inches of mercury. It is suggested that this equation be used in design calculations pending further investigation of its applicability to various geographical locations.

4. Examples of measurements of low temperature radiation received by vertical and inclined surfaces have been given. Because of the variability of ground surroundings from one location to another, additional observations are needed to establish the approximate magnitudes and range in this value for design use.

5. When the sky is completely overcast with a low thick cloud cover, the radiant energy emission of atmosphere and ground very closely approximates that of a black body at air temperature.

6. Correlation of the low temperature radiant energy emission of outdoor surroundings is needed with other weather design factors, such as cloudiness, solar radiation, dry bulb temperature and wind velocity.

References

1. Heat Transfer by Infrared Radiation in the Atmosphere, by W. M. Elsasser (*Harvard Meteorological Studies*, No. 6, Harvard University Printing Office, Cambridge, Massachusetts, 1942).

2. Radiation in the Atmosphere, by D. Brunt (Supplement to the Quarterly *Journal of the Royal Meteorological Society*, Vol. 66, 1940).

3. Monthly Mean Values of Radiation from Various Parts of the Sky at Benson, Oxfordshire, by W. H. Dines and L. H. G. Dines (*Memoirs of the Royal Meteorological Society*, Vol. 2, No. 11, 1927).

4. Notes on Radiation in the Atmosphere, by D. Brunt (Quarterly *Journal of the Royal Meteorological Society*, Vol. 58, 1932).

5. See p. 89 of Reference 1.

6. See pp. 90-92 of Reference 1.

7. Observations of Nocturnal Radiation at Fairbanks, Alaska, and Fargo, North Dakota, by H. Wexler (*Monthly Weather Review Supplement No. 46*, U. S. Government Printing Office, Washington, D. C., 1941).

8. Observations of Nocturnal Winter Atmospheric Radiation in California, by F. A. Brooks, C. Lorenzen, Jr., and L. M. K. Boelter (*Bulletin of the American Meteorological Society*, Vol. 20, Dec. 1939, p. 433).

9. Variation in the Nocturnal Radiation from the Sky with Zenith Distance and with Time During Night, by L. A. Ramdas, B. N. Sreenivasiah, and P. K. Raman (*Proceedings of the Indian Academy of Science*, Vol. 5, Sec. A, 1937, p. 45).

10. ASHVE RESEARCH REPORT No. 1333 — Measurements of Solar Heat Transmission Through Flat Glass, by G. V. Parmelee, W. W. Aubele, and R. G. Huebscher (ASHVE TRANSACTIONS, Vol. 54, 1948, p. 165).

11. ASHVE RESEARCH REPORT No. 1348 — Solar and Total Heat Gain Through Double Flat Glass, by G. V. Parmelee and W. W. Aubele (ASHVE TRANSACTIONS, Vol. 54, 1948, p. 407).

12. ASHVE RESEARCH REPORT — Solar Energy Transmittance of Eight-Inch Hollow Glass Block, by G. V. Parmelee and W. W. Aubele (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, September 1949, p. 111).

13. ASHVE RESEARCH REPORT — Solar Energy Transmittance of Figured Rolled Glass, by G. V. Parmelee and W. W. Aubele (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, February 1951, p. 124).

14. ASHVE RESEARCH REPORT — Overall Coefficients for Flat Glass Determined Under Natural Weather Conditions, by G. V. Parmelee and W. W. Aubele (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, December, 1948, p. 114).

15. ASHVE RESEARCH REPORT No. 1157 — Summer Cooling Load as Affected by Heat Gain Through Dry, Sprinkled and Water Covered Roofs, by F. C. Houghten, H. T. Olson, and C. Gutberlet (ASHVE TRANSACTIONS, Vol. 46, 1944, p. 235).

16. ASHVE RESEARCH REPORT — Heat Flow Through Unshaded Glass — Design Data for Use In Load Calculations, by G. V. Parmelee and W. W. Aubele (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, June 1950, p. 123).

17. Warm Air Heating Research, by C. W. Pollock (*Proceedings of the Pacific Gas Association*, Vol. 33, 1942).

18. ASHVE RESEARCH REPORT No. 1255 — Periodic Heat Flow — Homogeneous Walls or Roofs, by C. O. Mackey and L. T. Wright, Jr. (ASHVE TRANSACTIONS, Vol. 50, 1944, p. 293).

19. Effect of Heat Storage and Variation in Outdoor Temperature and Solar Intensity on Heat Transfer Through Walls, by J. S. Alford, J. E. Ryan, and F. O. Urban (ASHVE TRANSACTIONS, Vol. 45, 1939, p. 388).

APPENDIX A

The low-temperature radiation is calculated from readings obtained with the convection-compensated radiometer by means of the following heat balance equations. Subscripts a and b refer to data corresponding to the low and the high heat inputs respectively. All terms of the equations are in Btu per hour *per square foot of radiometer surface*:

$$\epsilon_r R + a_r I_a + Q_a = h_c (t_{ra} - t_{oa}) + \epsilon_r R_{ra} + L_a \quad \text{(A-1)}$$

$$\epsilon_r R + a_r I_b + Q_b = h_c (t_{rb} - t_{ob}) + \epsilon_r R_{rb} + L_b \quad \text{(A-2)}$$

where

a_r = absorptivity of the radiometer surface for solar radiation

ϵ_r = emissivity = absorptivity of radiometer surface for low-temperature radiation

h_c = convective conductance, Btu per (hour) (square foot) (Fahrenheit degree)

I_a, I_b = incident solar radiation, Btu per (hour) (square foot)

L_a, L_b = back losses from radiometer, Btu per (hour) (square foot)

Q_a, Q_b = electrical heat input to radiometer, Btu per (hour) (square foot)

R = low-temperature radiation emitted by the surroundings seen by the radiometer, Btu per (hour) (square foot)

R_{ra}, R_{rb} = radiation emitted by a black body at temperatures t_{ra} and t_{rb} respectively, Btu per (hour) (square foot)

t_{oa}, t_{ob} = ambient air temperature, Fahrenheit degrees

t_{ra}, t_{rb} = temperature of radiometer, Fahrenheit degrees

It is assumed that $a_r = \epsilon_r$ and that R and h_c do not change during the interval in which the two sets of readings are made, a matter of 10 to 15 min. The unknown value of h_c is eliminated by solving the two equations simultaneously so that:

$$R = Y\left[R_{ra} - \left(I_a + \frac{Q_a - L_a}{\epsilon_r}\right) - \left\{R_{rb} - \left(I_b + \frac{Q_b - L_b}{\epsilon_r}\right)\right\} + R_{ra} - \left(I_a + \frac{Q_a - L_a}{\epsilon_r}\right)\right] \quad \text{(A-3)}$$

where

$$Y = 1 \Big/ \frac{t_{rb} - t_{ob}}{t_{ra} - t_{oa}} - 1$$

The value of Y is dependent upon the values of Q_a and Q_b, ranging from 0.1 to 0.4. Calibration of the radiometer showed that ϵ_r was of the order of 0.98 and since a small error in ϵ has a smaller effect on R, ϵ_r was taken as unity for calculation purposes. The principal observations were measurements of I, Q, L, t_r and the temperature differential $t_r - t_o$. The latter was an average of ten readings taken at 10 sec intervals in order to minimize the effect of air temperature and wind velocity fluctuations.

Memorial Plaza

58th Annual Meeting Program Announced by President Seeley

The program planned for the Society's 58th Annual Meeting, to be held in St. Louis, January 28 to 30, has been announced by Pres. Lauren E. Seeley.

The meeting, which will have its headquarters in the beautiful Statler and Jefferson hotels, will be keynoted by an outstanding technical program and a full calendar of memorable social events, according to Bruce L. Evans, chairman of the Committee on Arrangements for the St. Louis Chapter.

A Welcome Luncheon scheduled for 12:15 p.m. on Monday, January 28, will officially launch the meeting, and the first of five technical sessions will follow at 2:00 p.m. Two more technical sessions will take place on Tuesday, January 29, and the final two are set for Wednesday, January 30. Among the many highlights of the technical program will be a symposium on the subject, *Control of Industrial Atmospheres,* which is scheduled for 2:00 p.m. on Tuesday, W. N. Witheridge acting as moderator.

While the program does not get under way officially until January 28, many officers and members will begin to arrive in the Mound City on Sunday, January 27, and earlier, since a Council meeting is scheduled for 10:00 a.m. on Sunday, in addition to a number of committee meetings set for various times the same day. To further avoid conflict with technical sessions, Monday morning and Tuesday evening have also been set aside for committee meetings.

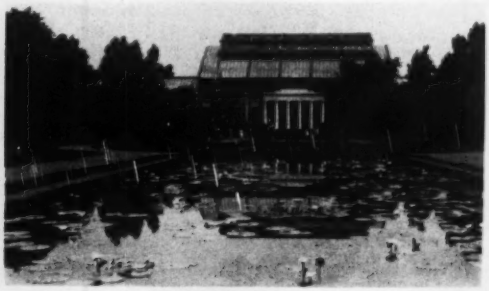
Those arriving Sunday or earlier can register at 1:30 p.m. on Sunday at the Statler. Those arriving later can register at 8:30 a.m. on Monday, also at the Statler. Early arrivals will be treated to a sightseeing tour of the many points of interest in St. Louis.

Social Program

The social program arranged thus far for the 58th Annual Meeting will swing into high gear on Monday morning, when the ladies set out for a tour of some of St. Louis' many handsome shops. On Monday afternoon, while the first technical ses-

The Jewel Box

Main Conservatory, Shaw's Gardens



sion is being held, the ladies will enjoy a tea and see an unique and highly interesting exhibit of shoes dating from revolutionary times to the present. In the evening, all will gather for a get-acquainted party.

Bright and early on Tuesday, the ladies will set off again, this time to the Park Plaza Hotel for a luncheon and fashion show which will feature the latest in gowns, coats, and furs. In the evening, all who do not have committee meetings will gather for a program of motion pictures.

On Wednesday afternoon, the ladies will travel to Shaw's Gardens to see the many beautiful floral specimens there and then will tour the famed St. Louis Art Museum. In the evening, the 58th Annual Meeting will reach its climax when members, their families, and guests gather in the Gold Room of the Jefferson Hotel for the traditional banquet.

There's Much to See

St. Louis offers much to see in beautiful structures, broad boulevards, handsome schools, impressive universities, lovely parks, historical docks and levees of the Mississippi, mammoth bridges, and many famous buildings found throughout the city.

A tour of the city will unfold the famed Statue of St. Louis, the old cathedral, the warehouse, the slave market, and the old rockhouse. All recall the abundant and fascinating history of St. Louis.

In newer St. Louis may be seen the Soldier's Memorial Plaza, the Civic Auditorium, the Federal Building, the Jefferson Memorial, the Municipal Theater and the Zoological Gardens.

Easy to Reach

St. Louis, which the Mound City Chamber of Commerce proudly and properly refers to as *the city surrounded by the United States*, is easily accessible from any point on the compass. No matter where the member may live or what mode of transportation he may choose for travelling, he can reach St. Louis in a comparatively short time.

Driving Mileage

To St. Louis from	
Kansas City	253 miles
Tulsa	437 miles
Oklahoma City	563 miles
Fort Worth	710 miles
Dallas	682 miles
Houston	846 miles
Denver	881 miles
Omaha	457 miles
New Orleans	745 miles
Memphis	305 miles
Louisville	266 miles
Indianapolis	242 miles
Columbus	416 miles
Cleveland	558 miles
Detroit	522 miles
Chicago	296 miles
Pittsburgh	597 miles
New York City	979 miles
Boston	1199 miles
Buffalo	744 miles

A short while ago, members received a special hotel reservation form. They are urged to return these forms as quickly as possible, to assure reservations of their first choice. All hotel reservations should be sent to Hotel Convention Bureau, ASHVE, Room 406, 911 Locust St., St. Louis, Mo.

Hotel Rates

	Jefferson	*Statler*
Single	$ 4.50- 8.00	$ 4.00- 7.00
Doubles	7.50-10.50	6.50- 9.50
Twins	8.00-11.00	7.50-11.00
2-Room Suites	18.00-28.50	23.50-24.00

The St. Louis Chapter cordially invites every member to come to St. Louis, January 28 to 30, for a meeting that they will always recall with a great deal of pleasure. Members of the Committee on Arrangements who are hard at work to make the meeting *the biggest and best yet* are listed on these pages.

St. Louis
Committee on Arrangements

Bruce L. Evans, *General Chairman*

G. W. F. Myers, *Vice Chairman* — W. J. Oonk, *Committee Secretary*

L. L. Hamig, *Chapter President*

Banquet—E. E. Carlson, *Chairman;* J. B. Killebrew, *Vice Chairman*; H. G. Faust, N. J. Hubbuch, Jr., L. R. Szombathy, H. F. Wilson.

Entertainment—J. S. Rosebrough, *Chairman*; E. T. Clucas, *Vice Chairman*; C. E. Brock, Jr., J. J. Casey, R. J. Kaenter, W. P. Norris, E. L. Schwager.

Finance—W. A. Klein, *Chairman*; F. E. Ince, *Vice Chairman*; C. F. Combs, R. H. Metcalf, C. K. Meyers, J. C. Watkins.

Ladies—H. C. Sharp, *Chairman*; H. R. Halt, *Vice Chairman*; J. T. Dabbs, C. A. Durphy, R. O. Reeves, L. M. Schwind, K. O. Williams.

Luncheon—J. W. Cooper, *Chairman*; E. C. Kuntz, *Vice Chairman*; M. J. Collins, Jr., G. D. Kingsland, R. H. Kremer, G. W. Pieksen.

Publicity—C. H. Burnap, *Chairman*; J. D. Rosebrough, *Vice Chairman*; W. D. Bevirt, K. J. Caplan, W. A. Otten.

Reception—J. H. Carter, *Chairman*; C. R. Davis, *Vice Chairman*; C. J. Baker, James Barry, Jr., J. A. Corrigan, T. J. Corrigan, J. E. Dube, H. E. Grossenbacher, H. A. Grossmann, C. A. Hoppin, Sr., H. J. Kipp, J. I. Levenhagen, J. T. Lynch, J. S. Malone, C. O. May, G. B. Pattiz, R. A. Schulte, J. E. Sharp, W. B. Simpson, R. C. Smith, R. J. Smith, S. M. Zivi.

Sessions—C. E. Hartwein, *Chairman*; L. W. Moon, *Vice Chairman*; N. B. Barsha, W. L. Dulle, L. W. Hundelt, G. B. Rodenheiser, W. A. Russell, B. C. Simons.

Special Events—J. F. Naylor, Jr., *Chairman*; M. F. Carlock, *Vice Chairman*; C. A. Beckermann, W. C. Kaber, Louis Steckhan.

Transportation—G. H. Bemarkt, *Chairman*; V. J. Suche, *Vice Chairman;* W. A. Bemis, P. X. Bergeron, J. L. Heiman.

SOCIETY MOVES TO LARGER QUARTERS

To better serve the requirements of a membership that has virtually tripled during the past decade, the Society has moved to new and larger quarters at 62 Worth St., New York City.

The new headquarters, occupying the entire fourth floor at the Worth Street address, comprises about 2750 square feet of floor space, a substantial increase over the former offices on the 30th floor of the New York Life Insurance Building, 51 Madison Avenue, New York City.

The new building, located near Broadway and not far from the municipal and court center of New York, was recently renovated and air conditioned at an estimated cost of a half million dollars. In addition to assuring pleasant working conditions for personnel, it is easily accessible by both east and west side subway.

This is only the third move for ASHVE in 40 years, and in each instance, it has been due to a sizable increase in membership. From 1911 to 1930, headquarters were in the Engineers' Building in New York City, and membership during that period grew from 400 to 2000. From the latter year until this month, Society offices were in the New York Life Building, and membership during this time rose from the 2000 figure to more than 8000 today. The Society was founded in 1894 by 75 Charter Members.

To insure fast and accurate handling of their correspondence with headquarters, members are urged to make a note of the new address and keep it in a conspicuous place.

WETHERILL MEDAL TO G. W. PENNEY

Dust particles in the air have long been a hazard to the health and cleanliness of industrial communities. For his development of a practical, workable method of combating this menace, G. W. Penney, holder of the George Westinghouse Professorship of Engineering at Carnegie Institute of Technology, and a member of the Society, has just been voted a John Price Wetherill Medal by the Franklin Institute. Formal presentation of the medal was made on October 17 during traditional ceremonies at the Institute, when honors were bestowed upon other distinguished scientists.

In announcing the award, Dr. Henry B. Allen, executive vice president of the Institute, quoted the accompanying citation which commends Professor Penney's *work in the development of a practical and commercially used electronic precipitator to remove particles of matter from ventilating air.*

The Wetherill Medal was established in 1925 and is given for discovery or invention in the physical sciences, or for new and important combinations of principles or methods known.

Electrostatic precipitators are now in general use for removal of industrial dust hazardous to the health of employees, for air cleaning to protect delicate apparatus or processes, to clean air in homes and offices, to clean air for the relief of hay fever and asthma, and to reduce damage to merchandise in stores. Commercially available electrostatic air cleaners used in connection with heating furnaces have shown a marked reduction in household cleaning in locations where atmospheric pollution is serious.

Electrostatic precipitation — the method with which Professor Penney has made such outstanding advances — has long been recognized as a practical method of removing very fine particles from gases, especially at elevated temperatures. Early observations and experiments in the field were conducted by Hohlfield as long ago as 1824, by Sir Oliver Lodge in 1844, and by Dr. Cottrell in 1906. However, authorities are agreed that Professor Penney is the scientist primarily responsible for the development of a practical unit of proven use.

Previous to Professor Penney's work, the application of electrostatic precipitation to other than special industrial uses was limited because of high D.C. voltages (30,000 to 100,000 volts), large space requirements, the generation of too much ozone, and high initial cost. Professor Penney was successful in developing a precipitator of a relatively small size, operating on 12,000 to 13,000 volts, and utilizing a fine wire ionization charging unit which permits operation with a very small and tolerable ozone generation.

Professor Penney was born in Stacyville, Ia., in 1898. After serving his country in World War I, he received his B.A. degree from Iowa State College and his M.S. degree from the University of Pittsburgh. Even before completing his work at the latter institution, Professor Penney began his long association with the Westinghouse Electric Co., where he developed his electrostatic precipitator. He worked at Westinghouse from 1923 to 1947, first as a research engineer, later as manager of the electro-physics department. During this period he also was lecturer at the University of Pittsburgh and worked in a civilian capacity with the Atomic Energy Commission, the Office of Scientific Research and Development, and the U. S. Army. He became the George Westinghouse Professor of Engineering at Carnegie Institute of Technology in 1947. He is a Fellow of the *AIEE*, and holds membership in Tau Beta Pi, Phi Kappa Phi, Sigma Xi, Eta Kappa Nu, the *American Physical Society*, and the *Society for the Promotion of Engineering Education.*

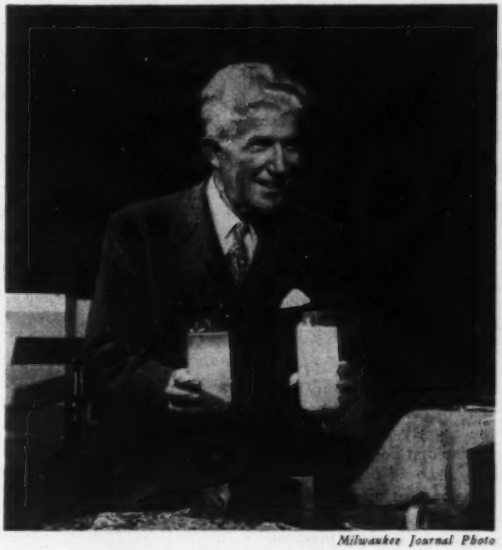
Wisconsin Chapter in Program to Attract Engineering Students

More than 1000 people jammed the Public Service Building in Milwaukee, Wis., September 19 for the first in a series of public demonstration lectures arranged by the *Engineering Society of Milwaukee* and affiliated professional societies to attract young men to the undermanned engineering profession. The Wisconsin Chapters of ASHVE and *ASRE* and Cutler-Hammer, Inc., co-sponsored the event with *ESM*.

The program itself, which provided tantalizing visions for the engineer of today and tomorrow, and which was extremely interesting and entertaining to the huge audience in general, was conducted by a six-man team from E. I. du Pont de Nemours & Co. Armed with more props than Blackstone the magician, as one Milwaukee paper put it the following day, was the demonstrator, L. F. Livingston, manager of du Pont's Extension Division. In a fast-moving act crammed with more showmanship than a Barnum could imagine, Mr. Livingston treated the audience to previews of new products of research, many of them not yet available for general use. His demonstration, however, assured potential engineers in the audience that there are many fields still to be explored.

Research has brought more good living to the people of the United States than anything else, Mr. Livingston said. He pointed out that the product of today, developed to meet only one need, might very well be the basis for an entire industry tomorrow. As an example, he referred to polythene which was applied during World War I as insulation for wire. Today, he revealed, it is the basis for an entire industry engaged in the manufacture of plastic containers and glasses.

You cannot stop research to rest on your laurels, because someone else may take the lead away from you, he warned. Although rayon was developed by his firm over 30 years ago, research in it is not yet over, for one synthetic fabric only leads to another, Mr. Livinston said.



Milwaukee Journal Photo

L. F. Livingston holds jars containing liquid silica product

The audience then saw a suit made of fiber which is extremely strong and wrinkleproof. It was worn by Dr. Joseph B. Quig, development section manager in du Pont's Rayon Technical Division, who disclosed that, although he had been wearing the suit for more than a month, it had yet to receive its first pressing.

Included among other products displayed but not yet available were an extremely fire resistant textile, explosive rivets with limited explosion for use in delicate construction, a fire-resistant synthetic fabric, and a silica product which permits oil to be quickly converted to grease by rearrangement of the molecular structure of the sand.

Prior to the demonstration, 128 people representing the four sponsoring groups gathered for a dinner in the Engineering Society Building. Highlight of this event was an address by E. W. Seeger, vice president in charge of development for Cutler-Hammer, Inc.

ASRE MEETS DEC. 2 TO 5

The annual meeting of the *American Society of Refrigerating Engineers* will be held at the Hotel Roosevelt, New Orleans, La., December 2 to 5, it was announced recently by M. C. Turpin, Secretary of the Society.

Expanding a procedure adopted a few years ago of having a concurrent conference and informal discussions on a specific subject, the program committee has decided on four such conferences, some of which will run concurrently with the regular technical sessions. These conferences are for the discussion of: (a) low temperatures (b) domestic refrigerator engineering problems (c) industrial insulation applications, and (d) packaged air conditioners.

Summary of Chapter Meetings*

• *CENTRAL OHIO*—September 17, 1951. The first meeting of the 1951-52 season was called to order by Pres. R. S. Curl in Cenci's Restaurant, Columbus. Business covered during a short session included financial and membership reports, election of nine new members, and announcement that the city code was to be acted upon October 11.

I. W. Cotton, chairman, Committee on Research, and president, The I. W. Cotton Co., Indianapolis, Ind., was the speaker of the evening. He addressed the group on the subject, *Research — A Challenging Field.* In his presentation, Mr. Cotton first outlined the current research program of the Society and then went on to emphasize that Society research is, *and always should be,* aimed toward the development of dependable data and not toward attempts to lead the field, as is felt in some quarters. The address was extremely interesting and well received, according to reports. Attendance 36.

• *EMPIRE STATE CAPITAL*—September 11, 1951. The meeting was called to order in Panetta's Restaurant, Menands, N.Y., with Pres. D. A. Carofano presiding. After members and guests had introduced themselves and Sec. G. G. Davis had announced that he was accepting applications for membership in ASHVE, the meeting was turned over to the guest speaker of the evening, J. L. Ottenheimer, consulting engineer, Albany, N.Y. In his address, *What is Expected of the Heating Engineer,* Mr. Ottenheimer stated that it was extremely important for the heating engineer to protect and foster his prestige as a professional man in the community. He then went on to discuss various heating problems, particularly some that had been encountered in the Capitol district in Albany. Attendance 28. Attendance ratio 0.62.

• *INLAND EMPIRE*—Pres. W. C. Vradenburg called the meeting to order in the Spokane Hotel, Washington, and minutes of the previous meeting were read and approved. Following a short address in which he thanked the officers of his own administration and introduced those elected for 1951-52, Mr. Vradenburg turned the gavel over to L. E. Marque, president-elect, who presided over the remainder of the meeting. Reports were then given by Tom Nau, who brought the membership up to date on the Chapter's financial condition; P. J. Favre, program chairman, who touched upon possible future programs; and Mr. Marque, who covered the Semi-Annual Meeting which took place in Portland last July. The speaker of the evening was Herb Webb, who provided an interesting presentation on the subject, *Oil Burner Controls and Flame Detector Equipment.* Attendance 27.

• *KANSAS CITY*—September 10, 1951. Three interesting addresses on the subject, *Combination Gas-Oil Burners,* highlighted the Chapter's regular monthly meeting in the Wishbone Restaurant, Kansas City, Mo. Providing presentations on the subject, one of the most widely discussed in the heating field today, were Cy Young, research engineer, Gas Service Co.; R. H. Siemon, president, Siemon and Co.; and Clark Lillis, president, Southern Oil Co. Mr. Young disclosed the point of view of the gas companies toward the equipment; Mr. Siemon provided equally interesting information on market demand and product design problems; and Mr. Lillis revealed the attitude of the oil distributor on the combination oil-gas burner.

In the business meeting which preceded the addresses, reports were given by W. A. Reichow, chairman of the program committee, T. I. Harriman, chairman of the entertainment committee, S. C. McCann, and J. G. Barnes, treasurer. Pres. C. W. Schumacher presided. Attendance 93. Attendance ratio 0.38.

• *MANITOBA*—September 20, 1951. The meeting was called to order by Pres. J. F. Bertram in Salon A of the Fort Garry Hotel. During a brief session concerning Chapter business, President Bertram appointed a committee to take charge of arrangements for the next meeting, consisting of: Joseph MacIntyre, T. W. Southey, and K. D. Wotten.

The speaker of the evening, Mr. Berkoff, chief chemist of Imperial Oil Limited, was then introduced by President Bertram. Mr. Berkoff gave an interesting talk on oil refining, with particular emphasis on internal combustion engine fuels. A question and answer period followed. Attendance 30.

• *MONTREAL*—September 17, 1951. Pres. J. G. Chenevert called the meeting to order in the La Salle Hotel and minutes of the previous meeting were read by Secretary B. J. Horsburgh and adopted as read. Business conducted in a lengthy session included development of final plans for the September 21 golf tournament, preparation of a list of hotels in which chapter meetings might be held, approval of Articles 1, 2, 3, 5 and 6 of the proposed chapter by-laws, and agreement that the standard operational guide could be adopted. Present at the meeting were Messrs. Chenevert, Hole, Noyes, Lindsay, Ker, Hennesey, LeFrancois,

*Note: The attendance ratios shown represent the membership attendance divided by the chapter membership. These ratios will be useful as a partial indication of interest shown by local chapter members in various types of subjects programmed by the various chapters and may be useful in deciding on subjects for chapter meetings.

Standring, Garneau, Cockman, and Horsburgh.

• *MONTREAL*—July 30, 1951. The meeting was called to order by Pres. J. G. Chenevert and the minutes of the previous meeting were read and approved. Chief among the business accomplished during a brief session was the decision to invite Prof. W. S. Harris, Dean L. E. Seeley, Society President, and George Bishop to be guest speakers for the October, November, and December meetings, respectively. Present at the meeting were Messrs. Chenevert, Noyes, Hennesey, Ker, and Horsburgh.

• *NORTH TEXAS*—September 17, 1951. A new attendance figure of 177 was established for North Texas Chapter meetings when the Chapter played host to local groups of *ASRE* and *NAPRE* and to a delegation of students from Southern Technical Institute at a joint gathering in Dallas.

Following the introduction of members and guests and a word of welcome to four new Chapter members, the meeting was turned over to L. S. Gilbert, program chairman. He introduced the guest speakers of the evening, R. L. Williams, sales manager, Kinetic Chemicals Division, E. I. DuPont deNemours, and James Merrill, representative of the same firm, who teamed to provide an interesting presentation on the subject of refrigerants.

Pres. R. G. Lyford presided. Attendance 177. Attendance ratio 0.49.

• *ST. LOUIS*—September 11, 1951. Following dinner, Pres. L. L. Hamig called the meeting to order and extended a special greeting to the ladies present, this being Ladies Night.

The minutes of the May 15 meeting were read and approved, after which a report on the Semi-Annual Meeting in Portland was given by B. L. Evans. Mr. Evans, general chairman of the Committee on Arrangements, spoke briefly on the coming Annual Meeting in St. Louis, and C. H. Burnap, chairman of the meetings committee, introduced the chairman of each committee and asked each chairman to report for his committee.

The speaker of the evening, W. H. Bryan, president of the St. Louis Convention Bureau, was then introduced by Mr. Burnap. Mr. Bryan spoke on *Functions of the Convention Bureau*, giving interesting information on the organization of the Bureau and outlining the many services it offers to organizations planning to hold conventions in St. Louis. Attendance 42.

• *SOUTH TEXAS*—September 12, 1951. The meeting was held at the Alabama Catering Service and following a social hour and dinner, Pres. R. J. Salinger called the business meeting to order. The minutes of the previous meeting and the treasurer's report were read and approved.

Chapter members O. G. Rivoire and G. C. Friddell, Jr., gave brief biographical sketches on their respective careers. W. L. Lashley reported on the activities of the membership committee and President Salinger announced that he had appointed I. A. Naman to select a committee for the purpose of contacting Society members in the Houston area who had not yet affiliated themselves with the South Texas Chapter. J. C. Lewis reported on the Engineer's Council meeting, advising that the symposium for 1952 had been organized for April 11 at the Rice Hotel, and that the subject will be *Research and Materials*. It was announced that D. S. Cooper, owner, D. S. Cooper & Assocs., Houston, would speak at the October 19 meeting on the topic, *Duct Design, Air Distribution and Sound Control*.

R. F. Taylor, second vice president of the Society, gave a brief report on the Semi-Annual Meeting at Portland. Attendance 59. Attendance ratio 0.22.

• *SOUTH TEXAS*—August 17, 1951. Pres. G. J. Collins called the meeting to order in the Alabama Cafeteria and the minutes of the previous meeting were read and approved.

Since there was no business to be conducted, the meeting was immediately turned over to the guest speaker of the evening, W. G. Brown, district manager, National Production Authority, United States Department of Commerce. In an interesting address on the subject, *Government Controls that are Related to Construction*, Mr. Brown provided timely information on the many problems confronting architects, engineers, contractors, and suppliers in the many phases of the building industry, and predicted an increase in defense production and a consequent decrease in civilian supply. A lively, hour-long question and answer period followed. Attendance 48.

• *SOUTHWEST TEXAS*—August 31, 1951. Pres. I. W. Wilkie called the meeting to order in the Nueces Hotel, Corpus Christi, and, following the reading and approval of minutes, a nominating committee was announced as follows: F. C. Benham, Jr., *chairman*; Boone Crisp, H. J. Faller, C. A. Mansheim, and M. K. Witt, Jr.

Since there was no other business to be conducted, the meeting was immediately turned over to the guest speaker, Dr. Frank Dotterweich, professor of gas technology, Texas A. & M. College. Dr. Dotterweich addressed the group on the air conditioning industry in general, providing some interesting information on its history and potential and pointing out that there is a rapidly growing demand for residential applications. Attendance 25. Attendance ratio 0.27.

Early the following morning, a party of 16 boarded the *Sally D* for the long-anticipated fishing trip, and, according to reports, it was well worth the wait, for everyone seemed to have a good time. Jack Hopping's son and daughter hooked big ones that didn't get away and took fishing honors.

Candidates for Membership

The Society's By-Laws require that all applications for membership or advancement are to be sent to the Executive Secretary and the names of applicants and their references shall be printed in the next issue of the JOURNAL of the Society, or mailed to all members. When the replies are received from references the Candidate's application shall be submitted to and acted upon by the Admission and Advancement Committee as soon as possible.

When the Admission and Advancement Committee has acted favorably upon a Candidate's application and assigned his grade, the Council shall confirm the election of the proposed Candidate for membership. During the past month there have been 53 applications for membership, including 2 student applications; in addition 2 advancements have been received. The names of these men and their sponsors are published in the following list.

Members are requested to scrutinize the list with care. The Admission and Advancement Committee, and in turn, the Council, urge members to assume their share of responsibility of receiving these candidates into membership by advising the Executive Secretary promptly of any whose eligibility for membership is in any way questioned.

All correspondence in regard to such matters is strictly confidential, and is solely for the good of the Society, which it is the duty of every member to promote.

Unless objection is made by some member by November 30, 1951, these candidates will be voted upon by the Council. Those elected to membership will be notified by the Executive Secretary immediately after election.

ANGUS, D. H. Asst. Br. Mgr., Anthes-Imperial Co., Ltd., Toronto, Ont., Canada. REFERENCES: L. L. Anthes, F. E. Ellis, Thomas Ferguson, R. A. Leith.

ARGUE, A. H., Pres. & Mgr., Silver Line Mfg. Co., Ltd., Winnipeg, Man., Canada. REFERENCES: J. F. Bertram, W. Cooke*, R. Schjerning*, M. Wylie*.

BALDWIN, W. G., Sales Engr., Canadian Sirocco Co., Ltd., Toronto, Ont., Canada. REFERENCES: F. G. Ewens, W. J. L. McLean, H. R. Roth, G. E. Smith.

BALZER, F. A., Partner, Balzer & Nightingale, Chicago, Ill. REFERENCES: G. W. Bornquist, P. J. Marschall, G. F. Nightingale, W. G. Pennington.

BATT, W. R., Mech. Designer, A. R. Salzer, Jr., New Orleans, La. REFERENCES: H. E. Faller, J. J. Friedler, Jr., A. R. Salzer, Jr., H. N. Stall.

BELL, W. M., Pres., Industrial Sheet Metal Co., Inc., Hammond, Ind. REFERENCES: H. O. Berg, J. H. Clarke, H. G. Gragg, J. W. Hosler.

BENNINGTON, E. D., Secy. & Treas., Industrial Sheet Metal Co., Inc., Hammond, Ind. REFERENCES: H. O. Berg, J. H. Clarke, H. G. Gragg, J. W. Hosler.

BULLOCH, T. H., Pres., Bulloch's Ltd., Winnipeg, Man., Canada. REFERENCES: W. J. Atkinson, J. F. Bertram, C. M. Fleming, A. W. Moss.

CASTAGNA, L. C., Draftsman, Albert Kahn, Associated Architects & Engineers, Inc., Detroit, Mich. REFERENCES: G. W. Akers, Saul Saulson, G. S. Whittaker, H. E. Ziel.

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CLARK, B. W., Sales Repr., The Trane Co., Greensboro, N. C. REFERENCES: W. D. Graham, Sr., W. D. Graham, Jr., F. J. Reed, E. A. Stroupe, Jr.

CLARK, THOMAS A., Tech. Dir., *National Warm Air Heating & Air Conditioning Association*, Toronto, Ont., Canada. REFERENCES: G. E. Pallister, D. O. Price, E. W. Taylor, G. A. Voorhees.

COALE, P. C., Field Engr., Perfex Corp., Baltimore, Md. REFERENCES: A. A. Marks, J. W. McGuire, J. H. Peterson, D. L. Wooden.

COOGAN, F. J., Partner, Proie & Coogan Heating Co., Pittsburgh, Pa. REFERENCES: C. L. Benn, H. J. Kirkendall, L. S. Maehling, A. E. Sumner.

DANDURAND, PAUL, Draftsman, Wiggs, Walford, Frost & Lindsay, Montreal, Que., Canada. REFERENCES: Robert Clapperton, R. R. Duquette, D. L. Lindsay, G. L. Wiggs.

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DE FIDE, R. J., Gen. Mgr., Proie & Coogan Heating Co., Pittsburgh, Pa. REFERENCES: C. L. Benn, H. J. Kirkendall, L. S. Maehling, A. E. Sumner.

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HESS, A. B., Owner, A. B. Hess Co., Spokane, Wash. REFERENCES: H. A. Bickel, L. D. Daniels, R. J. Harris, A. L. Niemoller.

ISAAC, W. C., Sales Engr., The Canadian Blower & Forge Co., Ltd., Montreal, Que., Canada. REFERENCES: A. B. Darling, W. G. Hole, B. J. Horsburgh, Ivan McDonald.

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MATZKIN, S. I., Htg., Vtg., Air Cond. Designer, Voorhees, Walker, Foley & Smith, New York, N. Y. REFERENCES: J. S. Brown, Stanley Dicker, Norman Goldberg, Gershon Meckler.

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NOBLE, D. W., Sales Engr., Ilg Electric Ventilating Co., Boston, Mass. REFERENCES: E. L. Blair, R. F. Curry, J. M. Frank, C. W. Stewart.

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SCHATKUN, PHILIP, Draftsman, Voorhees, Walker, Foley & Smith, New York, N. Y. REFERENCES: J. S. Brown, Stanley Dicker, Norman Goldberg, L. H. Monroe.

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SENTESY, LOUIS, Chief Draftsman, Walker and Associates Ltd., Hamilton, Ont., Canada. REFERENCES: G. Campagnola*, D. Forester*, G. E. Smith, J. E. L. Walker*.

SINES, C. F., Mech. Engr., Puget Sound Naval Shipyard, Bremerton, Wash. REFERENCES: A. C. Clark, D. L. Clark, C. B. Dominy, M. C. McLennan.

SMALLWOOD, WALTER, Mgr., Canadian General Electric Co., Quebec, Canada. REFERENCES: W. G. Hole, B. J. Horsburgh, R. J. Ker, R. R. Noyes.

STERLING, J. W., JR., Sales Engr., Johnson Service Co., Columbus, Ohio. REFERENCES: H. R. Allonier, C. E. Noel, R. W. Pirrung, P. D. Shepperd.

STONE, S. P., JR., Design Engr., A. R. Salzer, Jr., Con. Engr., New Orleans, La. REFERENCES: H. E. Faller, J. J. Friedler, Jr., A. R. Salzer, Jr., H. N. Stall.

TAIT, ERIC, Htg., Vtg. and Air Cond. Engr., The Foundation Co. of Canada, Ltd., Montreal, Que., Canada. REFERENCES: F. J. Friedman, J. L. Knight, L. A. C. Walford, G. L. Wiggs.

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WILES, J. H., Dust Control Test Engr., Pangborn Corp., Hagerstown, Md. REFERENCES: N. W. Eft, R. R. Garver*, P. R. Grossman*, J. L. Harvey*.

WILSON, R. D., Sales Engr., Johnson Service Co., Cleveland, Ohio. REFERENCES: Sherwood Nassau, J. N. Sampson, P. D. Shepperd, G. B. Supple.

WOOD, H. B., Sales Engr., J. R. Dowdell & Co., Dallas, Tex. REFERENCES: N. R. Collins, Jr., S. T. Lake, Jr., D. L. Moody, J. W. Smiley.

*Non-Member

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COUGHLIN, T. A.

UNIVERSITY OF MINNESOTA, Minneapolis, Minn. CERTIFIED BY: A. B. Algren.
JACOBSON, G. F.

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RAMSEUR, V. D., JR., Vice-Pres., V. D. Ramseur & Sons, Greenville, S. C. REFERENCES: C. Z. Adams, G. R. Morgan, R. A. Stipp, J. E. Waldrep.

COL. H. G. THOMPSON NAMED TO *EIC* POST

The president and council of the *Engineering Institute of Canada* recently announced the appointment of Col. H. G. Thompson, D.F.C., E.D., M.E.I.C., to the post of assistant general secretary.

Colonel Thompson is widely known in Canada through his activities in military, professional and industrial circles. His broad experience forms an excellent background for his new work with the Institute. His wide acquaintanceship within the profession will enable him quickly to be at home with his new duties and new surroundings, particularly when it is noted that he was on the staff of the Institute some years ago, associated with the work of the Engineering Catalogue.

Colonel Thompson was born near London, Ontario, and in 1922 was graduated from the University of Toronto with the degree of B.A.Sc. in mechanical engineering.

He joined the Institute as a student in 1920 and has been a corporate member since 1928. He is also a member of the *Association of Professional Engineers of Ontario*, the *Canadian Institute of Mining and Metallurgy*, and the *Institution of Mechanical Engineers*, and has been a member of the *American Society of Mechanical Engineers* for many years.

OBITUARIES

CHARLES L. TEMPLIN
Atlanta, Ga.

Charles L. Templin, president of the Carrier Atlanta Corp., and a member of the Society, died in Atlanta on September 17. He was 54.

Born in Paris, Ky., on August 7, 1897, and graduated from the University of Kentucky in 1919 with a B.S. degree in mechanical engineering, Mr. Templin spent his entire career in either the engineering or management phases of heating, ventilating, and air conditioning.

C. L. Templin

He first became connected with the Carrier operation in the early 1930's, when the York Heating and Ventilating Co., which he had served as southern representative since 1926, was merged with Carrier. He continued to work for Carrier in the same capacity until 1937, when he resigned to form the Carrier Atlanta Corp., heading the firm until the time of his death.

Other firms with which he was associated included the Milton Manufacturing Co., Milton, Pa.; Hersh Bros., Philadelphia, Pa.; Carolina Sheet Metal Works, Raleigh, N. C.; and the American Heating and Ventilating Co., also of Raleigh. During World War I, he served in the United States Navy.

Mr. Templin, who was elected to the Society in 1920, was a charter member of the Atlanta Chapter. In 1938, he served as president of the group and in 1941 was chairman of the membership committee.

He was a Mason and a Kiwanian and also held memberships in the *National Society of Professional Engineers* and the *Georgia Engineering Society*.

Mr. Templin is survived by his wife, Emily K. Templin, two daughters, Mrs. J. A. Gailey and Miss Frances Templin; and a son, Pvt. J. E. Templin, U.S.A.F.

The Officers and Council of the Society extend sympathy.

WALTER S. VOISINET
Buffalo, N. Y.

Walter S. Voisinet, manufacturers' representative and a member of the Society since 1930, died October 1 in Buffalo, N. Y., at the age of 52.

Mr. Voisinet was born in Tonawanda, N. Y., on May 27, 1899, and was graduated from Cornell University in 1920 with a B.S. degree in mechanical engineering. He spent most of his career in the heating, ventilating and air conditioning field in design, management, or sales capacities. Firms with which he was connected prior to becoming a manufacturers' representative several years ago were the Curtiss-Wright Corp.; Buckeye Blower Co.; The Herman Nelson Corp.; Hadley and Voisinet, of which he was a partner; Equipment Sales, Inc.; Giesecke-Kinsey Co.; Beman and Candee; and the Worthington Pump and Machinery Corp.

A noted golfer in the Buffalo area, Mr. Voisient won the Sheridan Park Golf Club Championships on several occasions and the Niagara Falls Invitation Tourney in 1941. He and his son, Walter S., Jr., captured the 1942 district Father and Son Tournament, and in 1947 he teamed with another son, James R., to win the same title again.

Also surviving are his wife, Hilda Opitz Voisinet, a daughter, Mrs. John J. P. Maloney of Evanston, Ill., a sister, Mrs. Norman E. Hansen, and two brothers, Louis J., and Otto E. Voisinet of Baltimore, Md., to whom the Officers and Council extend their sincere sympathy.

ROY D. TYLER
St. Petersburg, Fla.

Roy D. Tyler, a Life Member of the Society, passed away on October 6, in St. Petersburgh, Fla. He was 74 and living in retirement at the time of his death.

Born in Cleveland, Ohio, April 14, 1877, Mr. Tyler received his engineering education at Case Institute of Technology. During his career, he served in design engineering, executive, and sales positions for a number of well known firms. Organizations with which he was connected include the New York Central Railroad, as an engineering consultant; Montgomery Ward and Co., as general superintendent; Modine Manufacturing Co., as general sales manager; and the Standard Conveyor Co., as executive vice president.

R. D. Tyler

In addition, he was senior engineer in the Army Ordnance Department, Boston District, from 1941 to 1945, and a training officer for the Veterans Administration from the latter year until his retirement in 1947. A veteran himself, he served with the U.S. Army during the Spanish American War.

Mr. Tyler was also a life member of the *ASCE*, a Mason, a Shriner, and a member of Phi Delta Theta.

The Officers and Council extend sympathy to his wife, Christine B. Tyler, St. Petersburg; a son, Allen H. Tyler, Casper, Wyo.; a daughter, Mrs. Ruth N. Bortle, Bromall, Pa.; a sister, Mrs. Grace M. Cartwright, Kennebunkport, Me.; and a brother, Neal A. Tyler, Sr., Casper, Wyo.

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Heat Flow Through Glass: R. A. Miller, *Chairman;* A. B. Algren*, W. J. Arner, A. H. Baker, F. L. Bishop, E. W. Conover, W. B. Ewing, J. E. Frazier, J. S. Herbert, D. R. Muir, F. W. Preston, C. A. Richardson, Vic Sanders, H. B. Vincent, J. R. Young.

Heat Pump: R. C. Jordan, *Chairman;* E. R. Ambrose, C. F. Boester*, F. R. Ellenberger, W. F. Friend, C. F. Kayan, E. N. Kemler, J. Donald Kroeker, E. P. Palmatier, E. B. Penrod, S. S. Sanford.

Heating Load: W. S. Harris, *Chairman;* R. A. Biggs, A. I. Brown, R. S. Dill*, A. S. Griswold, J. M. Hartman, H. A. Lockhart*, L. G. Miller, T. F. Rockwell, S. I. Rottmayer, M. W. Shears.

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Human Calorimetry: G. L. Tuve, *Chairman;* E. F. DuBois, M.D., Nathaniel Glickman*, J. D. Hardy, E. R. Queer, L. E. Seeley, C. P. Yaglou.

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Insulation: M. W. Keyes, *Chairman;* R. E. Backstrom, L. A. Barron, C. B. Bradley, P. D. Close, R. B. Crepps, R. C. Cross*, N. B. Hutcheon, F. A. Joy, W. A. Knudson, E. R. Queer, H. E. Robinson, Vic Sanders, T. D. Stafford, L. V. Teesdale, R. K. Thulman.

Odors: T. H. Urdahl, *Chairman;* L. H. Beck, N. E. Berry, W. V. Consolazio, W. A. Grant*, E. P. Heckel, A. B. Hubbard, G. W. Meek, Amos Turk, W. N. Witheridge*.

Panel Heating and Cooling: P. B. Gordon, *Chairman;* A. B. Algren*, John Everetts, Jr.*, L. N. Hunter*, John W. James, J. S. Locke, S. K. Smith, J. M. van Nieukerken.

Group A — Heat Distribution Within and Behind the Panel: A. B. Algren*, *Chairman;* R. A. Biggs, R. S. Dill*, H. L. Flodin, F. E. Giesecke, J. H. Hart, G. D. Lain, R. L. Maher, D. L. Mills, C. W. Nessell, P. E. Parsons, S. I. Rottmayer, R. T. Schoerner, E. Scott, S. K. Smith, R. K. Thulman, S. M. Van Kirk, W. J. Widmer, L. H. Yeager.

Group B — Heat Transfer Between the Panel and the Space: J. M. van Nieukerken, *Chairman;* C. M. Ashley, C. F. Boester*, W. S. Harris, Linn Helander, J. W. James, C. F. Kayan, H. A. Lockhart*, W. E. Long, C. O. Mackey, R. A. Miller, G. W. Penney, H. F. Randolph, R. E. Sexton, H. E. Wheeler, G. L. Wiggs.

Group D — Controls: J. S. Locke, *Chairman;* A. B. Algren*, H. W. Alyea, Louis Barfus, S. D. Browne, R. L. Campbell, W. J. Hajek, A. J. Keating, H. H. Kieckhefer, W. H. Kliever, H. T. Kucera, J. F. McCauley, P. F. Neess, J. K. M. Pryke, C. W. Segnor, N. D. Skinner, F. P. Snyder.

Physiological Research: M. K. Fahnestock, *Chairman;* Lester T. Avery, Dr. Thomas Bedford, Capt. A. R. Behnke, Jr. (MC) USN, H. S. Belding, William Bruce, Dr. A. C. Burton, E. F. Du Bois, M.D., Col. A. P. Gagge, USAF (MSC), Nathaniel Glickman*, P. E. Hick, M.D., R. W. Keeton, M.D., D. H. K. Lee, M.D., R. D. Madison*, C. L. Taylor, C.-E. A. Winslow.

Sensations of Comfort: C. S. Leopold, *Chairman;* Lester T. Avery, John Everetts, Jr.*, M. K. Fahnestock, Nathaniel Glickman*, W. A. Grant*, A. J. Hess*, A. C. Menke.

Sorbents: G. L. Simpson, *Chairman;* G. C. F. Asker, F. C. Dehler, John Everetts, Jr.*, A. S. Gates, Jr., R. W. Gifford, H. W. Heisterkamp, E. R. McLaughlin, J. C. Patterson, F. J. Swaney.

Sound Control: T. A. Walters*, *Chairman;* C. M. Ashley, P. H. Geiger, Sidney Gordon, W. F. Hagen, H. C. Hardy, E. M. Herrmann, F. B. Holgate, G. C. Kerr, M. W. Keyes, R. D. Madison*, T. H. Troller, George Wohlberg.

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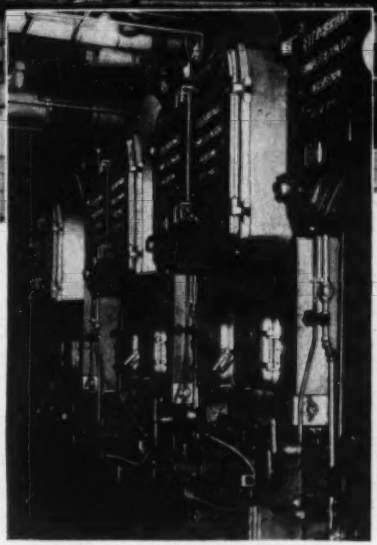

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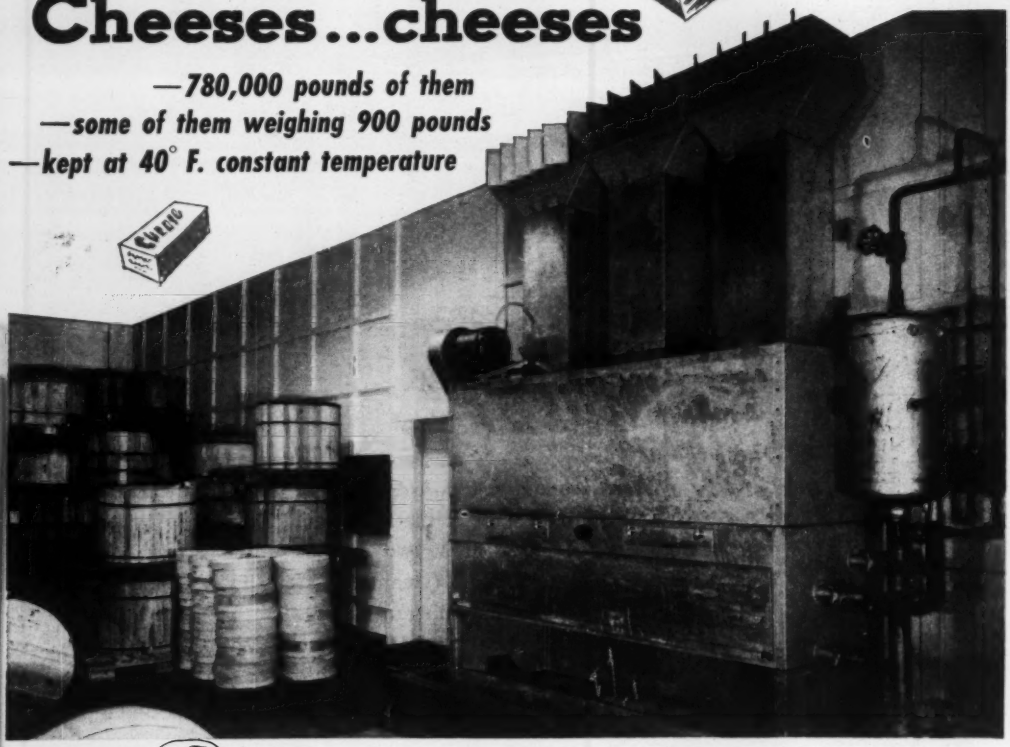

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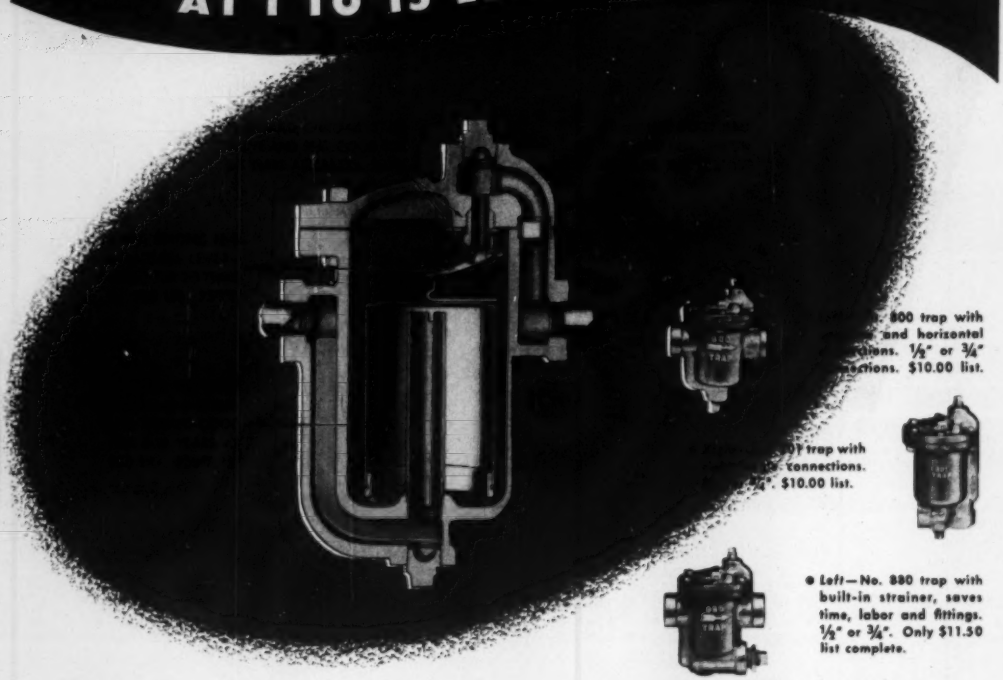

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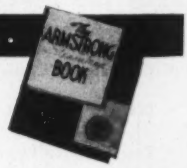

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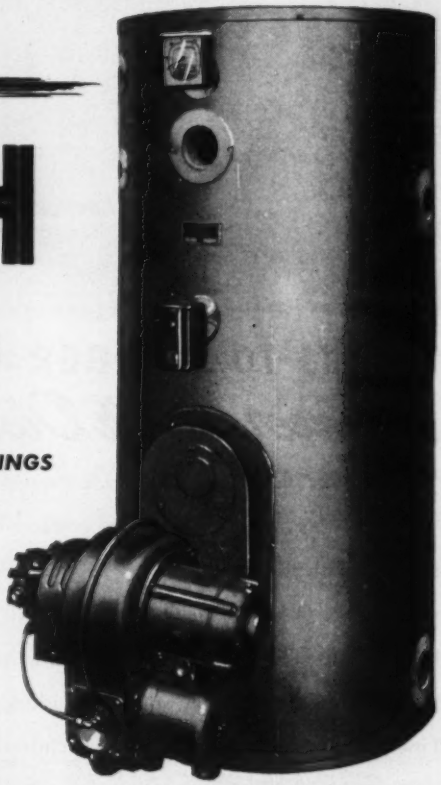
to Net More Profit from your Contracts . . .

Land the BIG ones



ALDRICH

HEAT-PAK

BOILER-BURNERS

- APARTMENTS
- RESTAURANTS
- FIRE HOUSES
- GARAGES
- RESIDENCES
- STORES
- DEFENSE PLANTS
- MUNICIPAL BUILDINGS
- CHURCHES
- MOTELS

The big jobs net the high profits. To land those big contracts, make your bid with Aldrich Heat-Pak Boiler-Burners. It's the logical line to push for any size steam or hot water system — in seven sizes, delivering up to 808,000 BTU per hour. Engineered for fuel-saving *complete* combustion, with vertical fire-tube boilers for highest efficiency. Aldrich units come shipped *complete*, ready to set in place and connect. And for a sales clincher how's this: Boilers when specified can be furnished with interchangeable oil or gas burner provision at no extra charge permitting ready conversion in the field. Write for details today, furnishing name of nearest jobber.

Jobber inquiries invited

ALDRICH HEAT-PAK PRODUCTS

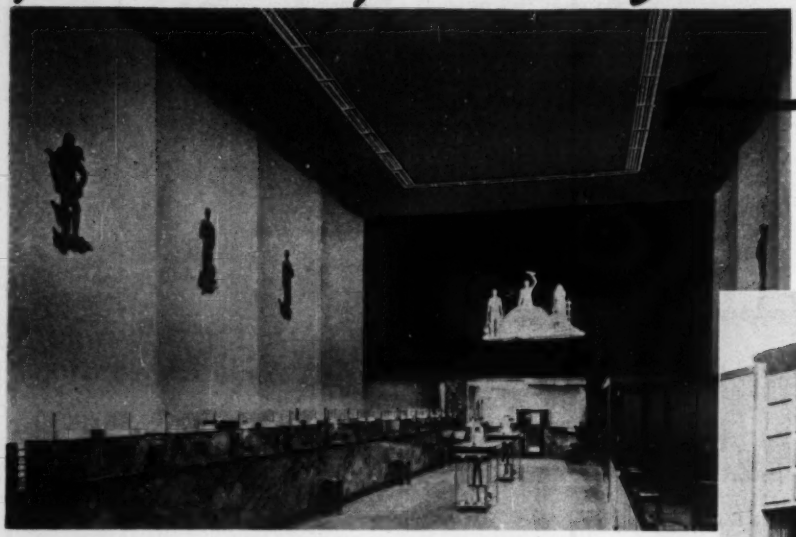
ANOTHER BREEZE MARK PRODUCT

the ALDRICH Company

103 Williams Street, Wyoming, Illinois

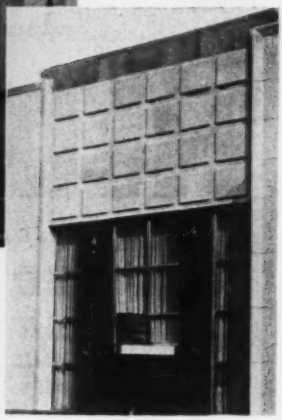
A subsidiary of Breeze Corporations, Inc.

Good Looking and Comfortable Too



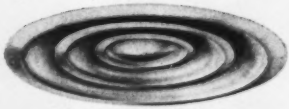
PEOPLES SAVINGS BANK
Evansville, Indiana

Architect and Builder: Bank Building and Equipment Corporation of America, St. Louis, Missouri.

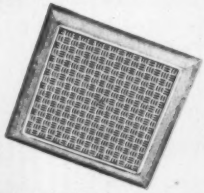


THANKS TO BARBER-COLMAN
Engineered Air Distribution

"Good looks" are more than brick deep in this modern banking structure. Customer and employee comfort have also received the important attention they deserve. Proper air distribution is assured with Barber-Colman Line-O-Flo units. This line-type ceiling outlet can be used singly, or in continuous strips as illustrated above. For low pressure drop, low noise level, and high diffusion efficiency, Line-O-Flo is the choice of leading architects, engineers, and contractors. Line-O-Flo Ceiling Outlets are dimensionally coordinated for use with acoustical ceilings and other building products.



MODEL "J" VENTURI-FLO CEILING OUTLET— Adaptable to either flush ceiling installations or to installation on exposed ducts. Write for bulletin F-4085-1.



ADJUSTABLE SQUARE CEILING OUTLET — For acoustical tile or plaster ceilings. Available in recessed or surface types. Adjusts to any distribution requirement. Bulletin F-4728 gives full details.

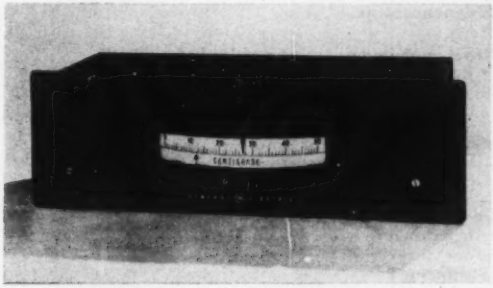
BARBER COLMAN

Send for Bulletin F-2741, which gives complete performance data, dimensions, and helpful installation suggestions.

BARBER-COLMAN COMPANY, 1228 Rock St., Rockford, Illinois

ANNOUNCING:

New G-E resistance thermometers accurately indicate and control low temperatures



FOUR TYPES AVAILABLE—indicators, protectors, and two- or three-position controllers—for either flush or surface mounting.

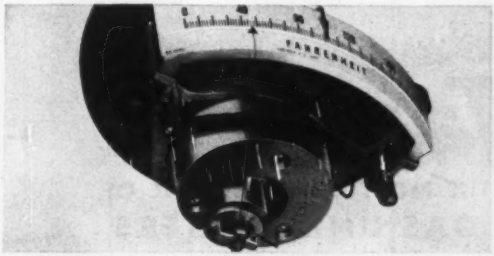
TEMPERATURES FROM −100 F TO +300 F can now be accurately indicated and controlled with General Electric's new line of resistance thermometers. They indicate accurately within ½ of 1 per cent full scale. Any change in temperature equivalent to 1/10 of 1 per cent full scale starts immediate control action.

Normal changes in humidity or room temperature do not affect the exactness of control. Neither does a change in control voltage. Sturdy, simple construction assures reliable operation under severe operating conditions.

NARROW TEMPERATURE SPANS, as small as 90 degrees, are available anywhere in the −100 F to +300 F range. For complete information, contact your nearest G-E representative or write Section 602-224 for Bulletin GEC-835. General Electric, Schenectady 5, New York.

GENERAL ELECTRIC

602-224



RATIO-TYPE MECHANISM stands up against hard usage and holds accuracy despite shock and vibration. Sturdy construction assures dependable service and also fewer maintenance problems.

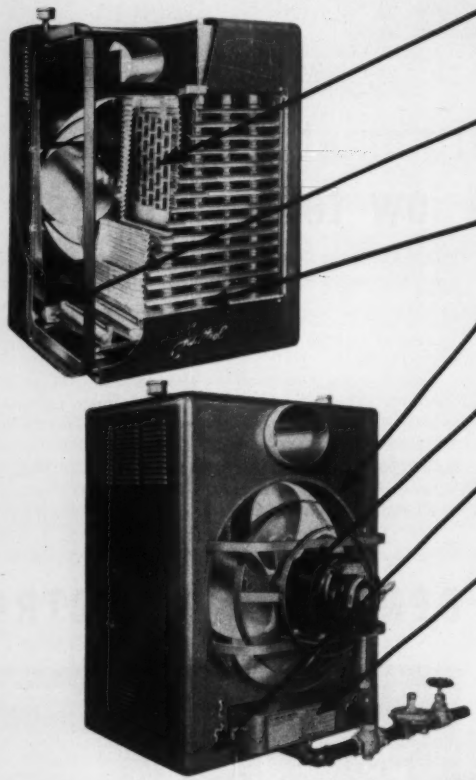
ADJUSTING SET POINT of Type HP-13 resistance thermometer is quick and easy. New General Electric instrument provides high sensitivity and accuracy, yet is simply and sturdily constructed.

Features that are a result of

®Janitrol *Complaint-Free Engineering*

While constant laboratory research and development has made the major contribution to the advanced design of Janitrol equipment . . . Complaint-free engineering is also a result of 26 years of intensive field studies of actual unit heater installations to provide better performance and lower maintenance costs.

And, thousands upon thousands of Janitrol Unit Heater installations, many of which operate under severe conditions such as found in foundries, machine shops and many heavy industries attest to the plus performance you can confidently expect from Janitrol complaint-free engineered equipment.



Multi-Thermex heat exchangers with internal turbulator baffles provide fast heat transfer, long life assured by use of special chrome alloy steel.

Ampli-Fire ribbon burners produce a clear blue, short flame, operation is extremely quiet. Each burner is centered within the lower end of each heat exchanger for compactness, even heat distribution.

Automatic Safety Pilot assures positive ignition, more than 100,000 installations prove its dependability.

Direct-a-Flow principle provides an equalized air flow over all heat transfer surfaces, design eliminates possibility of hot spots.

Special Design Motor and Fan Assembly, balanced combination features extra long life, quietness and heat to floor performance.

Hinged Panel Construction—Bottom of unit swings down to provide easy accessibility for burner inspection and primary air shutter adjustment.

Streamlined Enclosure protects all electrical connections of motor, safety pilot, electric gas valve and overheat control.

***WRITE** for your copy of the "Businessman's Blue Book of Better Heating," it illustrates and diagrams how unit heaters are best installed for greatest efficiency.*

®Janitrol

THE MOST COMPLETE LINE OF

GAS UNIT HEATERS

operate with all gases including LP.

SURFACE COMBUSTION CORPORATION • TOLEDO, OHIO

nyb

Investigate

COMET
Unit Heaters

BUILT TO MEET MODERN INDUSTRIAL REQUIREMENTS FOR CONTINUOUS HEATING SERVICE UP TO 150 POUNDS STEAM PRESSURE

Horizontal Type

Ceiling suspension type with heavy duty welded steel fin-and-tube heating element. The rugged arc-welded construction out-performs and outlasts heating elements made of thinner non-ferrous metals. Avoids their expansion-contraction faults, yet has the same BTU efficiency. Ten basic sizes with capacities from 30 Mbh to 490 Mbh. Totally enclosed motors. (Extra heavy non-ferrous coils also available.)

Vertical Projection Type Also Available

For efficient heating from high-ceiling areas—for door heaters over small openings—or where the horizontal type Comet Heater is not applicable. Ten basic sizes; capacities from 27 to 332 Mbh.

●

WRITE FOR BULLETINS
No. 513 HORIZONTAL TYPE
No. 484 VERTICAL TYPE

nyb

THE NEW YORK BLOWER COMPANY

SALES OFFICES • 32nd STREET and SHIELDS AVENUE • CHICAGO 16
FACTORY, LAPORTE, INDIANA

Zallea Expansion Joint News

PUBLISHED BY ZALLEA BROTHERS—WORLD'S LARGEST MANUFACTURERS OF EXPANSION JOINTS EXCLUSIVELY

Expansion Joint of the Month

OPERATION D-E-E-P FREEZE

LOW PRESSURE TYPE

The Zallea Low Pressure Corrugated Expansion Joint is used to absorb vibration and protect machinery. Made of stainless steel, these joints are of the non-equalizing type and are limited in

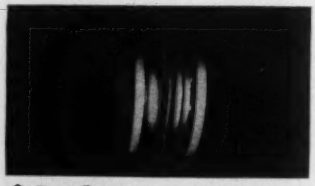


Figure 7

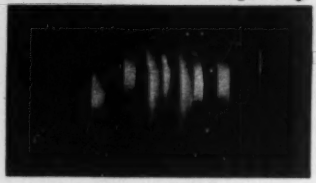


Figure 8

service to ½" maximum axial movement and 50 lbs. maximum working pressure. Furnished with a single corrugation (Figure 7), or with multiple corrugations (Figure 8), they are primarily used on condensers, turbines, stage bleeders, pumps, and between connected equipment where slight movement and vibration occurs. Industry, with its increasingly high temperature problems, relies on the Zallea Low Pressure Corrugated Expansion Joint for smooth flow and maximum operating performance. For your expansion problem, always specify the *best* in expansion joints . . . specify *Zallea*, you'll find it pays!

. . . a brand new 4-page folder on *all* Zallea Expansion Joints. Send for your copy of Bulletin 351 today!

ZALLEA BROTHERS, 816 Locust Street, Wilmington 99, Delaware.

Our Readers Ask

Q. *A friend and I recently had a friendly argument over copper vs stainless steel expansion joints. What are your views? A. T. M., Conshohocken, Pa.*

A. Except where corrosive conditions prevent, stainless steel may be used wherever copper is used. Although slightly more expensive in its initial cost, the use of stainless steel will result in much lower overall cost because of its increased life. Having approximately three times the tensile strength of copper, stainless steel elements can be made with a wall thickness approximately ⅓ that required for copper to withstand the same working pressure. As the life of a corrugated element varies inversely with the thickness of the element, a stainless steel expansion joint will last several times longer than a copper expansion joint designed for the same operating pressure.

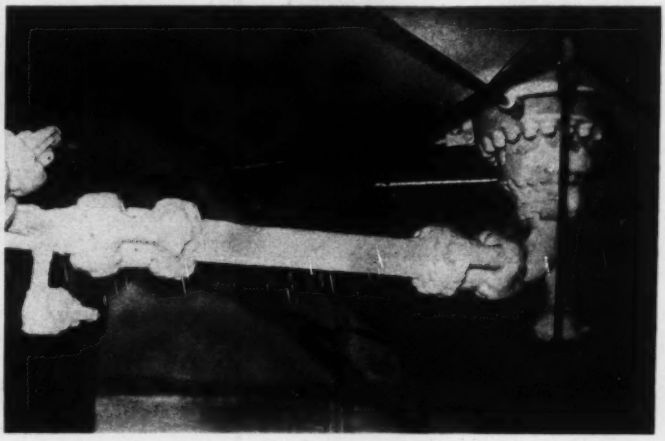
Your questions are welcomed. Address all letters to Engineering Dept. 917.

Temperature and Pressure Problem Solved by Zallea

Recently Zallea engineers were faced with a problem of developing expansion joints for operation on a liquid oxygen line, operating at —320° F., under extreme pressure at a large classified government facility. Because of the unusual nature of this installation, Zallea engineers designed *both* the piping layout and the expansion joints. Special stainless steel alloys were selected for the expansion joints to withstand the severe operating conditions.

Zallea Joints Tested

Shown here in operation, under a heavy layer of frost, are two of a group of 14 six inch Zallea Toroidal Hinged Type Stainless Steel Expansion Joints, with stainless steel construction throughout including the hinges and flanges. Prior to shipment, these Zallea Stainless Steel Expansion Joints were factory-tested to 1400 pounds hydrostatic pressure for a period of 8 hours to insure long life and satisfactory job performance.



1. Superior Construction
Close-coupled construction with pump and motor on a single shaft assures accurate alignment and maximum rigidity to maintain that alignment. Bearing and seal life are prolonged. All units are equipped with high-grade mechanical seal which requires no maintenance and no adjustment when the pump is installed. Motors are of a well-known standard make which have passed thorough Allis-Chalmers tests for reliability. Ball bearings are of the sealed type, which means they will run for years without attention.

2. Easy Mounting in Any Position
The simple two-screw mounting bracket makes it easy to mount this pump in any position or location as long as the motor end of the shaft is horizontal or above. You save time, trouble and installation cost. The same basic pump design is also available in a vertical model specially designed for sidewall mounting in tanks and basins without special provisions. The discharge flange is simply bolted to the side of the tank.

3. Ample Engineering Assistance
A competent Allis-Chalmers pump application engineer with wide experience in applying air conditioning pumps will be glad to help you select exactly the pump you need for dependability at lowest cost. These qualified engineers can often suggest cost-saving changes in your installation. And they have a complete range of types and sizes to choose from. Next time you need help on your pumping problems, call the Allis-Chalmers Authorized Distributor or District Office near you. Or write Allis-Chalmers, Milwaukee 1, Wisconsin and ask for Bulletin 52B 7529. A-3320

Sold . . .
Applied . . .
Serviced . . .
by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.

MOTORS — ½ to 25,000 hp and up. All types.

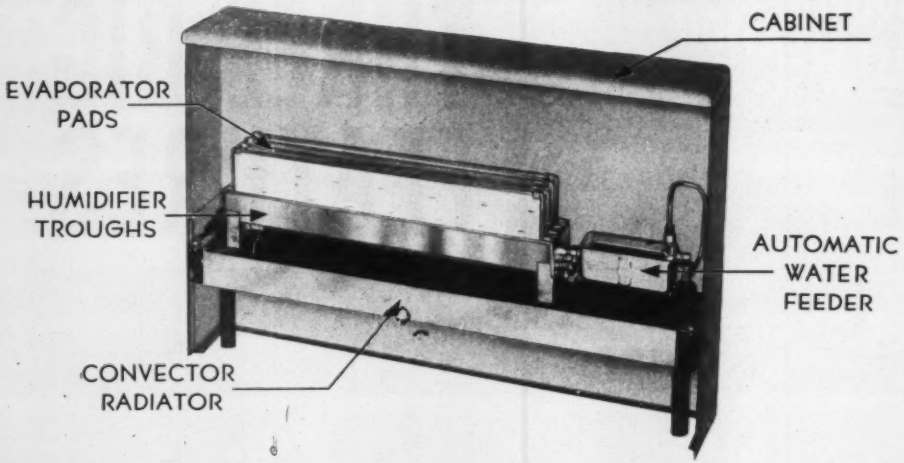
CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

TEXROPE — Belts in all sizes and sections, standard and Vari-Pitch sheaves, speed changers.

Texrope and Vari-Pitch are Allis-Chalmers trademarks.

ALLIS-CHALMERS

NOW! AUTOMATIC HUMIDIFIERS FOR CONVECTOR RADIATORS



The only automatic humidifier on the market made especially for modern convector radiators!

BIG FEATURES

- Only 3-⅜ inches deep. Fits even the extremely shallow convector cabinets.
- Water is supplied directly to feeder from the convector on hot water systems. On steam installations, water is taken from nearest supply through copper tubing.
- Completely automatic. Float-controlled valve keeps water line constant.

BIG PERFORMANCE

- Maximum evaporating area. Unique design of water troughs make every inch of this humidifier a working surface which creates more evaporating area.
- Minimum air restriction. The separate, narrow ⅜ inch troughs which hold the evaporator pads are spaced to allow free flow of heated air between the pads and on all sides of unit.

Available in both 2 and 4 trough units in 10 different sizes.

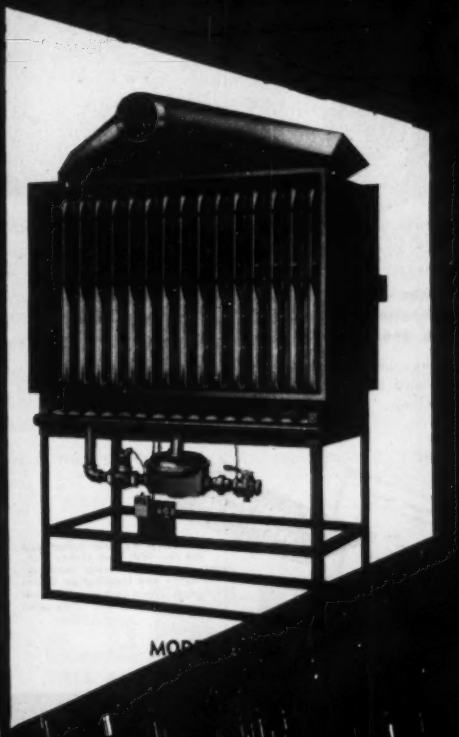
The new Maid-O-Mist Convector Humidifiers are made in evaporating capacities of 1 to 5 gallons per day. Construction throughout is of non-ferrous metal. Easy to install. Get full information from your jobber or write us direct for complete details.

MAID-O-MIST Inc.
HEATING SPECIALTIES

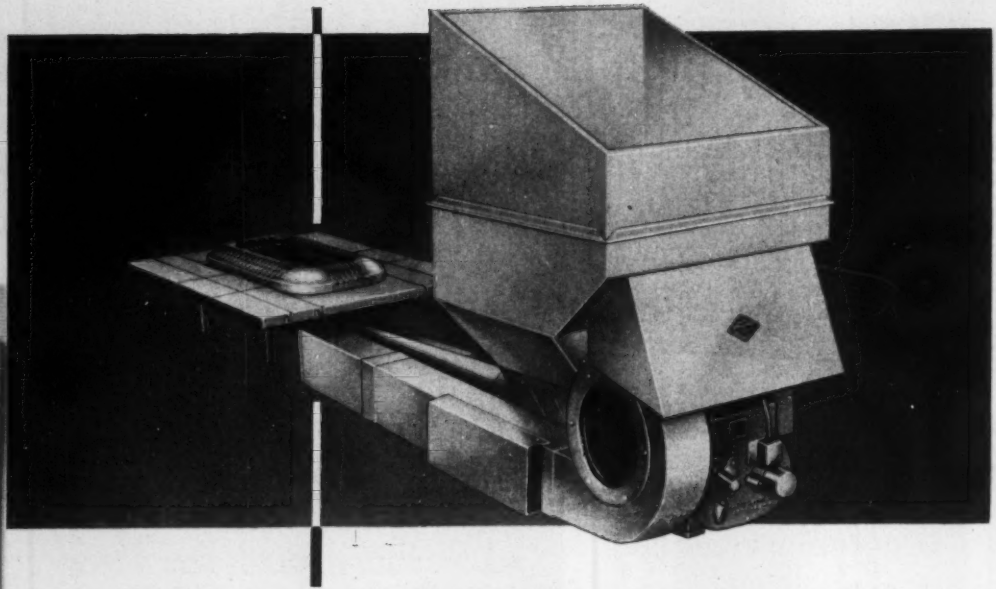
AUTOMATIC HUMIDIFIERS . . . . . AUTO-VENTS
WATER LINE CONTROLS . HEATING SPECIALTIES

MAID-O-MIST, Inc.

3217 NORTH PULASKI ROAD . CHICAGO 41, ILL.



A WILL-BURT STOKER
makes a good coal-heat installation BETTER

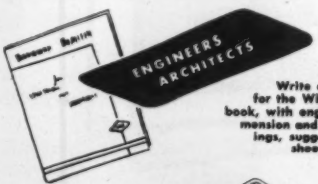


There is no guess-work when you specify or install a Will-Burt stoker. Its design, materials and workmanship are the result of 20 years of field and engineering experience.

The effective, trouble-free Will-Burt automatic air control is one of the important Will-Burt contributions to efficient combustion and smoke abatement. In fact, Will-Burt ***originated*** the application of air control to stokers within the Will-Burt size range. The Will-Burt air-control device has proved its superiority throughout these many years.

The quality which characterizes ***every*** detail of a Will-Burt stoker insures approval by the buyer for him who specifies or installs a Will-Burt. Will-Burt stokers build reputations . . . year after year after year.

They are available in a full range of sizes, hopper and bin fed, in capacities up to 600 pounds per hour.



Write on your letterhead for the Will-Burt stoker data book, with engineering facts, dimension and installation drawings, suggested specification sheets, etc. Valuable!

OTHER WILL-BURT HEATING PRODUCTS

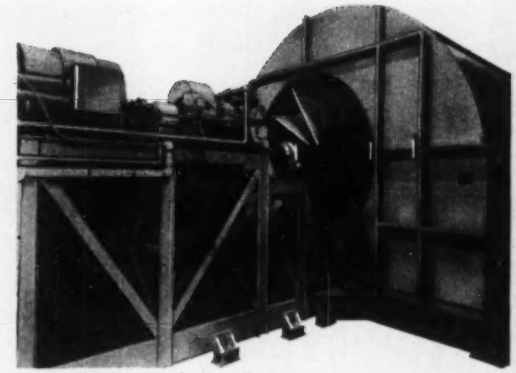
Gas and oil conversion burners

Residential hot-water heating boilers

WILL-BURT

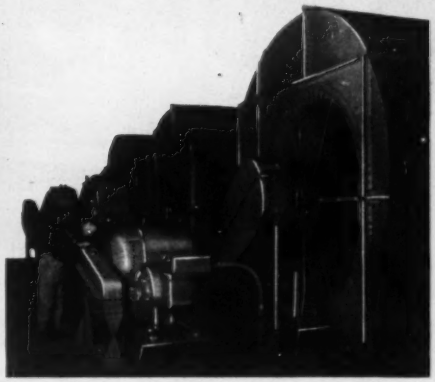
THE WILL-BURT COMPANY

DEPARTMENT H ORRVILLE, OHIO



SKF-equipped Buffalo Forge Company Air-Conditioning Fan Installed in Kaufmann's Department Store, Pittsburgh.

SKF-equipped Westinghouse Corp., Sturtevant Division Ventilation Fan Installed in Brooklyn-Battery Tunnel.



why do so many prefer SKF?

It's pretty hard *not* to buy good bearings today, but SKF is the preferred bearing with many air-conditioning manufacturers.

There are good reasons why!

These manufacturers know SKF as a reliable, friendly supplier. They've learned to have implicit confidence in the experienced bearing engineering specialists at SKF's headquarters. They appreciate the teamwork of SKF field men who are qualified specialists in the application of bearings to air-conditioning equipment.

Their customers know the value of the complete maintenance service available to them through SKF's Distributor Organization.

Whatever your product, your engineers and designers can have this helpful SKF teamwork simply by asking for it. 7288

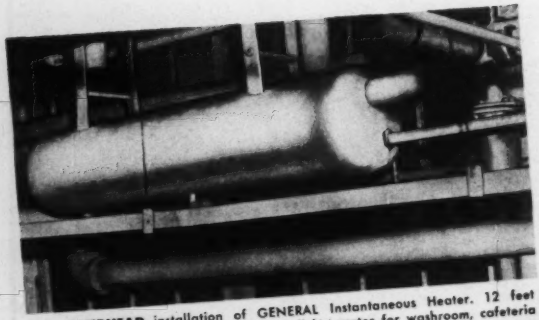
SKF® BALL AND ROLLER BEARINGS

SKF-equipped Westinghouse Corp., Sturtevant Division Fan Installed in Washburn Tunnel, Houston, Texas.

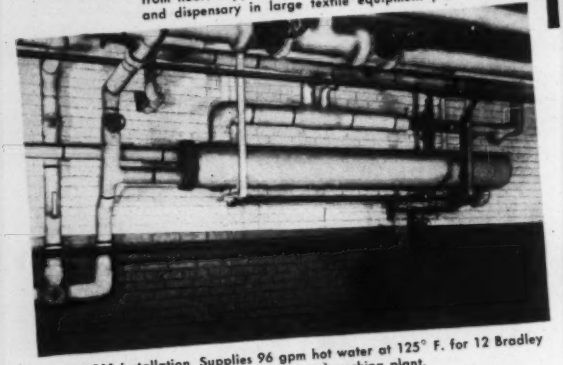
8 REASONS WHY **SKF** IS PREFERRED BY ALL INDUSTRY

integrity • craftsmanship • metallurgy
tolerance control • surface finish • product uniformity
engineering service • field service

SKF INDUSTRIES, INC., PHILADELPHIA 32, PA. — *manufacturers of* **SKF** *and* HESS-BRIGHT *bearings.*

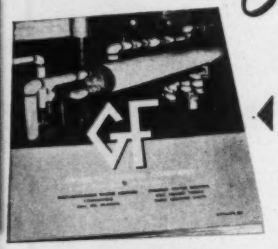


OVERHEAD installation of GENERAL Instantaneous Heater. 12 feet from floor. Supplies all hot water for washroom, cafeteria and dispensary in large textile equipment plant.



WALL installation. Supplies 96 gpm hot water at 125° F. for 12 Bradley wash fountains in leading metal working plant.

More efficient Hot-Water Supply *that needs no floor space!*



Get NEW

COMPLETE CATALOG 60!

This 12 page catalog is packed with profitable ideas for industrial plants. Describes complete GENERAL line: instantaneous water heaters, converters, coil heated tanks, and other equipment.

Complete sizing data, steam consumption tables, photographs and diagrams are included to simplify selection and installation.

SEND NOW!

General Fittings Co.
Dept. A., 123 Georgia Ave., Providence 5, R. I.

Please send me your new, complete Catalog No. 60 of industrial water heating equipment.

Name .....

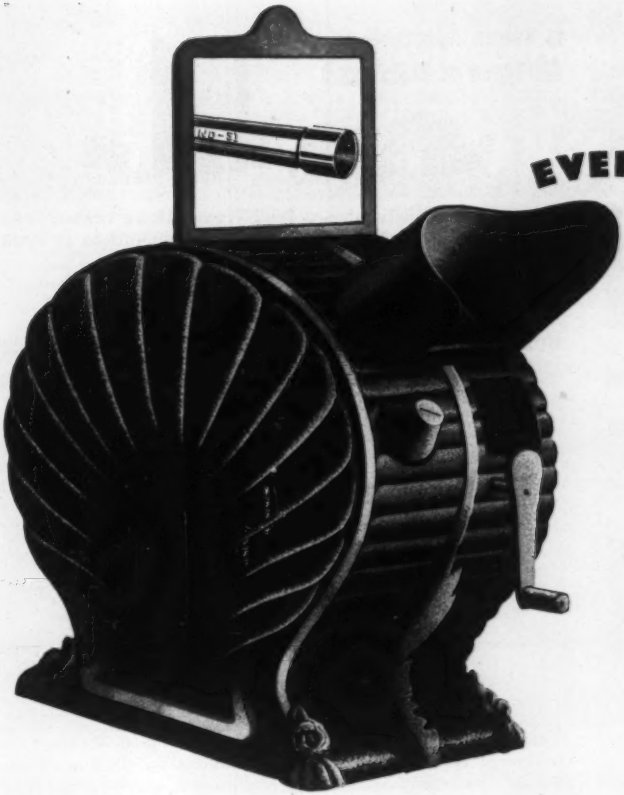
Street .....

City ..... State .....

Wherever space is available — near the ceiling, on the wall, in a corner — that's where you can install GENERAL Instantaneous Heaters. You don't have to crowd your boiler room, or subtract from valuable production area.

The many advantages of these compact water heaters are especially important today in helping you meet increased hot water requirements at minimum cost. There's no bulky tank, no excavation, no complicated piping. You save money on both installation and operation. Water is heated instantly and continuously by steam supplied through shell.

GENERAL Instantaneous Heaters are available in 21 sizes with capacities to 300 gals. per minute. Mail coupon today for complete information.



EVER LOOK INSIDE?

Clean as a whistle—inside as well as out! That's the result of crack supervision and inspection that goes on constantly at the Wheatland Mills.

Wheatland's method of producing galvanized pipe assures you of a clean surface *inside* as well as *out*—your assurance of pipe built to *last*—Indeed "the pipe with the yearmark" is always the pipe of *quality!*

—pipe with the yearmark!

WHEATLAND TUBE COMPANY
BANKERS SECURITIES BLDG., PHILADELPHIA 7, PA.

VULCAN HAS THE ANSWER!

---- for COMMERCIAL AND RESIDENTIAL HEATING REQUIREMENTS

Made in Canada under the trade-name of Heal Radiation by the Vapor Car Heating Co. of Montreal.

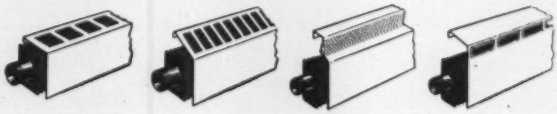
Is Vulcan Adaptable to All Types of Buildings?

Yes. Both Vulcan Baseboard Radi-Vector (Home heating) and Vulcan Standard (Commercial) require no alterations or extra calculations for installing.

Does Vulcan Cut Installation Costs?

Yes. Vulcan in-line fin tube radiation requires less pipe and fittings.

Is Vulcan Easy to Install?



Linovector Type F | Linovector Type S | Radi-Vector Type L | Radi-Vector Type K

Commercial Radiation **Residential (Baseboard Radi-Vector**

Yes. Vulcan is as easy to install as a length of pipe. It comes cut to desired length, ends threaded or chamfered for quick assembly. Sturdy, patented Vulcan hangers eliminate much of the hard work of installation. Attractive covers, in several styles, are designed for easy hanging.

DISTRIBUTORS IN PRINCIPAL CITIES

Availability of Material Subject to Government Regulations.

Is Engineering Information Easily Available?

Yes. Vulcan catalogs give complete detailed information on Residential Baseboard Radi-Vector and Commercial Standard Radiation. *Catalog 53A features new I-B-R ratings* for Baseboard Radi-Vector. Catalog 125 has complete engineering data on Vulcan Standard.

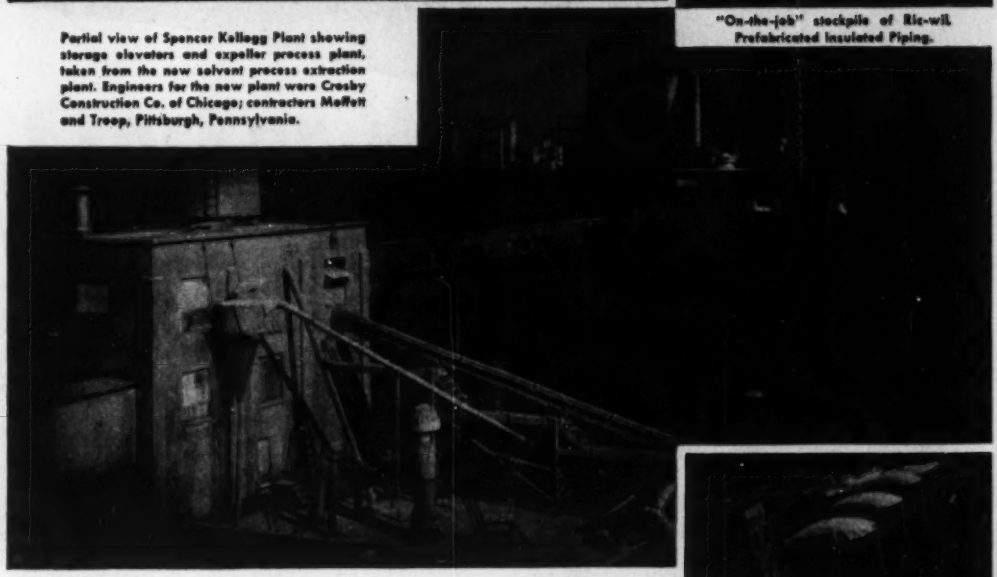
The VULCAN RADIATOR Company

16 Francis Ave., Hartford 6, Connecticut

OVER TWENTY-FIVE YEARS A LEADER IN FIN-TUBE RADIATION

Another RIC-WIL INSTALLATION FOR YEARS OF TROUBLE-FREE TOP PERFORMANCE

"On-the-job" stockpile of Ric-wil Prefabricated Insulated Piping.



Partial view of Spencer Kellogg Plant showing storage elevators and expeller process plant, taken from the new solvent process extraction plant. Engineers for the new plant were Crosby Construction Co. of Chicago; contractors Moffett and Troop, Pittsburgh, Pennsylvania.

RIC-WIL PREFABRICATED INSULATED PIPING SPEEDS UP INSTALLATION

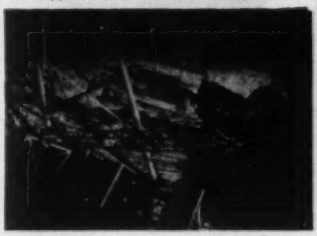
The solvent extraction process used in the new Spencer Kellogg soy oil extraction plant at Decatur, Illinois, requires extensive piping systems for conveying cold and recirculated water, steam, condensate, soy oils, and solvents.

The use of Ric-wiL Prefabricated HEL-COR Piping for overhead lines speeded up installation and provided the system with maximum insulation and protection. Two 4-inch lines carrying soy oil and a steam tracer line for proper temperature control were nested in a solid insulation cylinder and housed in a 16-gauge ingot iron conduit, helically-corrugated and zinc galvanized. For additional corrosion resistance, outside of conduit was coated with high melting point asphalt and inside coated with baked-on phenolic resin.

All accessory piping units such as elbows, tees, and expansion loops were prefabricated by Ric-wiL, insuring simple, fast installation when they reached the job.

This installation is indicative of how Ric-wiL may solve your insulated piping problems. A Ric-wiL representative near you will give you complete information without cost or obligation, or if you prefer, write to The Ric-wiL Company, Dept. 7-TA, Cleveland, Ohio.

View showing oil tanks and pipe hanger supports for the new extraction plant.

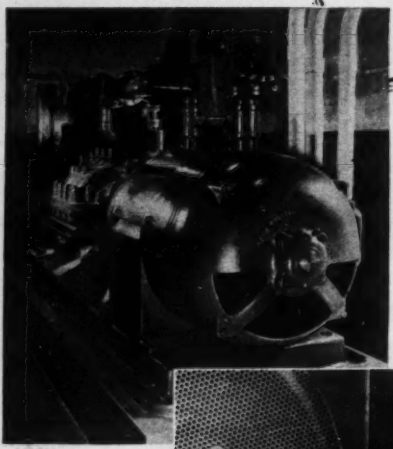


Crane assists in positioning Ric-wil Piping in elevated installation.

RIC-WIL
INSULATED PIPING SYSTEMS

OVERHEAD — THE RIC-WIL COMPANY · CLEVELAND, O. — UNDERGROUND

FOR FORTY YEARS THE GREATEST NAME IN INSULATED PIPING SYSTEMS

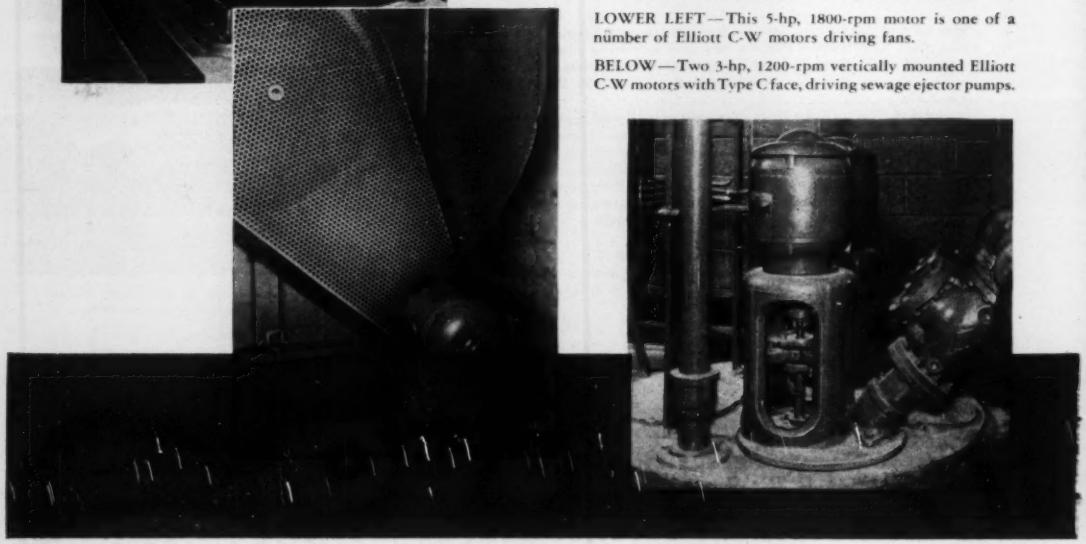


ABOVE — Three 60-hp, 3600-rpm and four 150-hp, 1800-rpm Elliott C-W motors driving pumps.

UPPER LEFT — An Elliott C-W 200-hp, 1800-rpm wound-rotor protected-type motor drives the main fire pump.

LOWER LEFT — This 5-hp, 1800-rpm motor is one of a number of Elliott C-W motors driving fans.

BELOW — Two 3-hp, 1200-rpm vertically mounted Elliott C-W motors with Type C face, driving sewage ejector pumps.



Crocker-Wheeler

Protected-Type

MOTORS

■ More and more you see them — driving pumps, fans, compressors and other equipment in heating and air conditioning systems. Crocker-Wheeler Protected-Type motors get the nod for their quiet, steady operation and low maintenance qualities. Their design provides full protection against common hazards such as moisture, oil, dust and grit. They're built throughout to assure long, dependable service with minimum upkeep. The bearings, for example, are double-row width, pre-lubricated and *sealed*. They'll go at least five years without attention.

Crocker-Wheeler Protected-Type motors are in good buildings everywhere because engineers and contractors recognize their advantages for building service. These advantages are fully covered in Bulletin SL-300-1A.

SEND FOR A COPY

Address your request to Elliott Company, Dept. H, Jeannette, Pa.

The New 100 Park Avenue Building, N. Y.

Towering high above mid-town, New York City, this completely air conditioned structure is an example of the latest in commercial buildings. Sixty Crocker-Wheeler motors are installed in the air conditioning system.

Kahn & Jacobs, Architects
George A. Fuller Co., General Contractor
Jaros, Baum & Bolles, Mechanical & Electrical Engineers
Kerby Saunders, Inc., Air Conditioning, Heating & Ventilating Contractor

Elliott C-W motors range from 1 to 200-hp. Larger Elliott motors and generators are built by the Ridgway Division in Ridgway, Pa.

CW-18

ELLIOTT COMPANY

Up-to-the-minute FACTS YOU NEED *about* MARSH Heating Specialties

In this new catalog you will find 52 pages of boiled down, usable information covering Marsh Heating Specialties—equipment that has been first choice of those who insist on highest quality and efficient, trouble free performance.

It includes a section on the famous Marsh Packless Valves and renewal bonnets; sections on Marsh radiator traps, float and thermostatic traps, float traps, boiler return traps, inverted bucket traps, strainers, venting devices and related equipment. There is also a section on boiler gauges and interesting facts about the widely used Marsh-Tritrol Method of automatic control of space heating from outside temperature. Included in the pages are typical installation diagrams covering the application of Marsh valves, traps, strainers, and venting devices.

MARSH HEATING EQUIPMENT CO.
Sales affiliate of Jas. P Marsh Corporation
Dept. T, Skokie, Ill.

Write for Catalog 76-H

KENNARD Engineered

56 Sizes

Sprayed Coil Dehumidifiers

6 Sq. Ft. to 81 Sq. Ft.—Air Volumes up to 48,600 CFM

This large range of sizes makes Kennard Sprayed Coil Dehumidifiers adaptable to any requirement of space or capacity for year-round air conditioning—cooling and dehumidifying in summer, humidifying in winter, evaporative cooling in spring and fall, and at all times washed and cleaned air.

Features of Construction—Sump pan, eliminators, casing and coil frames all galvanized construction—bolted together construction of casing with Silicon Bronze or Stainless Steel nuts and bolts—complete with recirculated spray water piping, brass water make-up valve and spray nozzles. Coils available for either Direct Expansion or Water—fabricated with copper tubes and fins. Pump and Motor Assembly is optionally available.

Representatives in Principal Cities

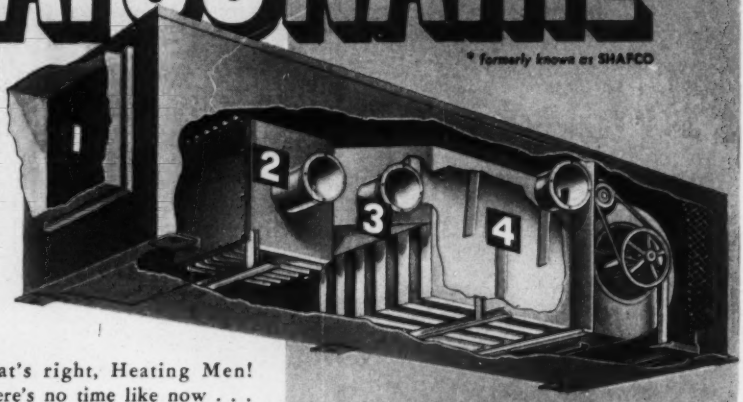
Write for name of nearest representative and complete information on Air Conditioning Blower Units—Finned Coils — Evaporative Condensers — Cooling Towers.

KENNARD CORPORATION • 1817 S. HANLEY ROAD ST. LOUIS 17, MO., U.S.A.

NOW'S THE TIME TO "TIE IN" WITH

SHAFCONAIRE*

* formerly known as SHAFCO



Leader in the Overhead Oil-Fired Heating Market

That's right, Heating Men! There's no time like now . . . *right now* to get set with SHAFCONAIRE OverHead Heaters. They're big business boosters, extra profit producers. For SHAFCONAIRE, you know, is the original suspended oil-fired furnace known for years as SHAFCO. It's quality-built from end to end . . . designed especially for use in commercial and industrial buildings. Not just a domestic floor-type unit tilted horizontally on its side. And SHAFCONAIRE has been time-tested, thoroughly proved in use . . . the only furnace of its type backed by over 12 years actual operation in the field.

MODELS from 100,000 to 405,000 B.T.U. for single or multiple unit installation to meet a wide range of commercial and industrial heating requirements.

OVERHEAD HEATERS, INC.

(formerly SHAFCO Distributing Corporation)

1354 BOOK BUILDING • DETROIT 26, MICHIGAN

And here's something to talk about

4 ESSENTIAL FEATURES FOUND ONLY IN SHAFCONAIRE

1. BUILT-IN PLENUM CHAMBER—An exclusive patented feature that saves you plenty of time, trouble, and guess-work in making installations. Assures uniformly heated warm air output, eliminates on-the-job sizing and extra sheet metal work. Just top off ducts from end, top or both sides to meet installation requirements.

2. HEAVY DUTY CONSTRUCTION—Use of heavy gauge welded boiler plate assures long-life, trouble-free operation. No warping, no buckling, no burn-outs common to stamped steel construction.

3. INTERMEDIATE HEAT-TRAVEL SECTION—Patented intermediate chamber between refractory-lined firebox and heavy gauge heat exchangers serves to spread flame and eliminate impingement on metal. Permits expansion of hot gases, improves operating efficiency.

4. EFFICIENCY ENGINEERED HEAT EXCHANGER—Alternately spaced baffle plates in each of the heat exchanger sections effectively retard the flow of hot gases toward stack connection, permit maximum transfer of heat.

OVERHEAD HEATERS, INC.
1354 BOOK BUILDING • DETROIT 26, MICHIGAN

Please send me complete information and Price Lists on SHAFCONAIRE (formerly SHAFCO) OverHead Heaters.

*Name*_____

*Company*_____

*Address*_____

*City*_____ *Zone*____ *State*_____

DON'T DELAY! SEND COUPON TODAY!

You'll get complete details and price information on the "hottest" bet for extra profits in the present heating market.

Lounge and exterior, Veterans Memorial Building, Detroit, Mich.
Architects and Engineers: Harley, Ellington & Day, Inc., Detroit, Mich.
General Contractors: Kuhne-Simmons Co., Inc., Detroit
Air Conditioning Contractors: American Refrigerating Co., Detroit

Simply beautiful

kno-draft
adjustable air diffusers

In their beautiful simplicity of line, Kno-Draft Adjustable Air Diffusers are grace notes for any decorative theme. But unless you just happened to look ceilingward, you might not ever notice them in the modern lounge above. Nor would they be more obtrusive in period surroundings.

Certainly, Kno-Draft Adjustable Air Diffusers will never call attention to themselves by discomforting the occupants of any room. All that their name implies, Kno-Draft Adjustable Air Diffusers circulate air gently and *without draft* . . . keep temperature uniform throughout the conditioned area. Air volume and flow pattern are adjustable *after* installation . . . thus simplifying the engineering of the job as well as providing flexible control to meet both present and future conditions.

You'll find Kno-Draft Adjustable Air Diffusers in many of America's notable and architecturally significant buildings. Whatever the air conditioning requirements, there are types and sizes to meet them. Write us for detailed information.

KNO-DRAFT DATA BOOK: Complete specifications, engineering and installation data on Kno-Draft *Adjustable* Air Diffusers. To get your copy, simply fill in and mail the coupon. No obligation, of course.

TRADE MARK "KNO-DRAFT" REG. U. S. PAT. OFF.

W. B. CONNOR ENGINEERING CORP.
Danbury, Connecticut
Air Diffusion • Air Purification • Air Recovery
In Canada: Douglas Engineering Co., Ltd.,
190 Murray Street, Montreal 3, P. Q.

W. B. CONNOR ENGINEERING CORP.
Dept. G-111, Danbury, Connecticut
Please send me, without obligation, my copy of the Kno-Draft Air Diffuser Data Book.

Name .....
Position .....
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Street .....
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. . . YET SCRAP INVENTORIES ARE ALARMINGLY LOW. *YOU* ARE BEING COUNTED ON TO HELP KEEP THE FURNACES WORKING . . . TO AID DEFENSE

With our increased steel production, the furnaces are gobbling up an enormous amount of iron and steel scrap.

More—far more—scrap than is at present going into their scrap stockpiles.

Many mills are operating on a hand-to-mouth basis. Some are already threatened with shut-down—for lack of scrap.

The Danger Is Increasing

Will efforts to fill the tremendous demands for steel fail because of lack of scrap?

Steel is made from 50% scrap. We could be severely handicapped—in our aim to keep abreast of both military and civilian requirements—if scrap suppliers can't keep pace with productive capacity.

But they *can* keep pace . . . with your help!

Enough Scrap IS Available!

Yes—the only problem is to get the available extra scrap from where it is—to where it's needed.

Where is it?

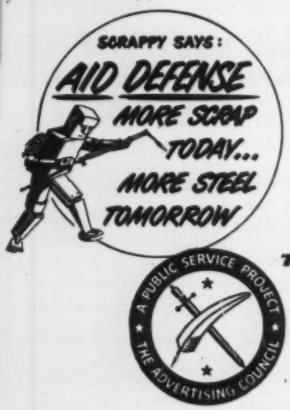
In *your* business . . . in the form of old machines and equipment, tools, implements, dies, jigs, fixtures, outmoded structures, chains, valves, wheels, pulleys—any old iron and steel that's rusting away.

Six Million EXTRA Tons Needed!

By the end of 1952, we'll be producing steel at an annual rate of 20 million tons more than in 1950. That means we will need at least 6 million more tons of scrap than we've ever needed before.

It's up to you. Write at once to Advertising Council, 25 W 45 St., New York 19, N. Y., for a free copy of "Top Management: Your Program For Emergency Scrap Recovery".

Please write today—there's not a day to lose.

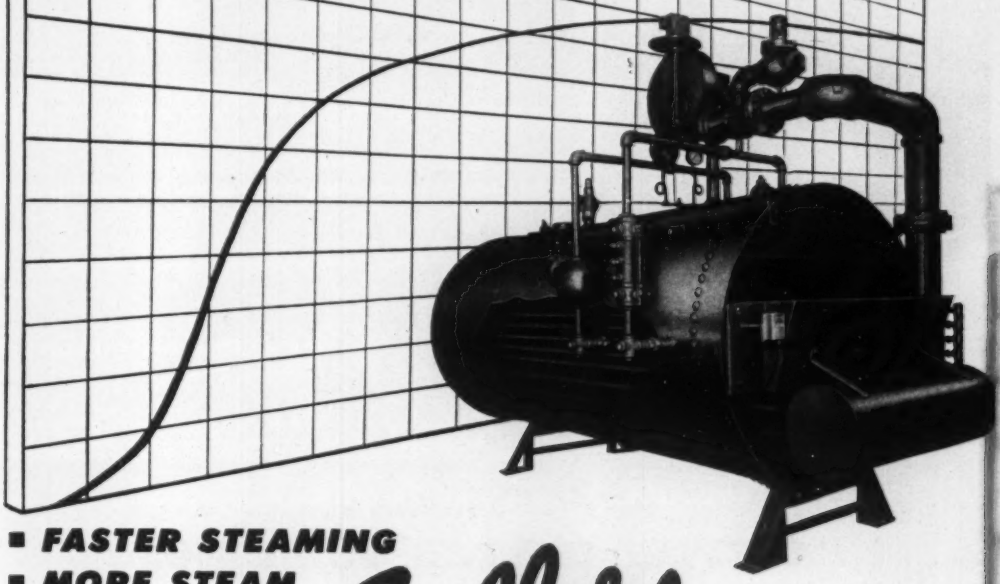


NON-FERROUS SCRAP IS NEEDED, TOO!

This advertisement is a contribution, in the national interest, by

Heating, Piping and Air Conditioning

CHOOSE YOUR BOILER BY ITS STEAM CURVE



- ***FASTER STEAMING***
- ***MORE STEAM***
- ***DRY STEAM***

with *Sellers* **IMMERSION STEAM BOILER**

You buy a boiler for just one thing — to produce **steam.** You want **dependable** steam production and you want it at the **lowest** possible cost. The Sellers immersion firing principle gives you more steam, dry steam, faster steaming, plus lower operating cost and lower maintenance. Here are the basic advantages in Sellers design which gives you these results:

1. The firing tubes in a Sellers are completely submerged. Every atom of heat goes directly into the water — Result: Maximum heating efficiency.
2. The water surface area is nearly three times that of a conventional boiler of comparable capacity. This means faster steaming and dry steam because surging is eliminated. No water line corrosion.
3. Scale can't build up to interfere with heat transfer. Lime deposits on the outside of the firing tubes are automatically cracked off and fall to the bottom of the shell, as the tubes expand and contract with intermittent firing.

Whether you require steam for heating or process purposes, it will pay you to carefully investigate the Sellers Immersion Steam Boiler. Available in twelve sizes to meet all standard requirements. All are built to A.S.M.E. Power Codes. Our Bulletin No. 1206-C will give you full details. Write for it today.

SELLERS ENGINEERING COMPANY

4876 North Clark Street **Chicago 40, Illinois**

Blast Heaters. Immersion Automatic Water Heaters. Vertical Steam Boilers. Air Heaters. Combustion Units. Industrial Gas Burners. Immersion Tank Heaters. Gas Combustion Equipment

MULTI-VENT

T.M. Reg. U.S. Pat. Off.

Low Velocity Air Diffusion CEILING PANELS

in Pittsburgh's

GATEWAY CENTER BUILDINGS

Multi-Vent panels have been specified throughout for diffusing both cooled and heated air in all the interior bays of the first three office buildings, now under construction.

Eggers & Higgins, Architects
Meyer, Strong & Jones, Consulting Engineers

Selected for . . .

TRULY DRAFTLESS, NOISELESS AIR CONDITIONED COMFORT . . .
for over 8000 office workers, summer and winter.

Plus these great advantages possible only with Multi-Vent...

COMPLETE FREEDOM IN LOCATING MOVABLE PARTITIONS
Partitions may even bisect a diffusing panel without disturbing in any way Multi-Vent's incomparable over-all uniformity of room air movement, temperature, and humidity.

COMPLETE FREEDOM IN LOCATION OF LIGHTING FIXTURES . . .
for Multi-Vent panels are completely concealed in standard acoustical ceilings, and in no way interfere with interior design.

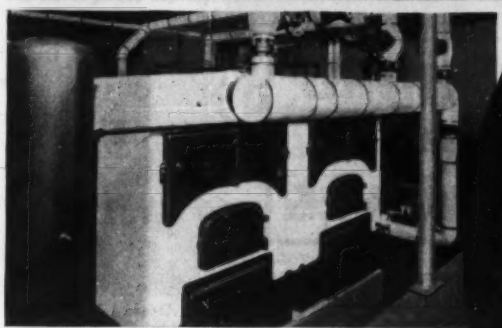
RADIANT PANEL HEATING AND COOLING EFFECT ADDS TO THE COMFORT FACTOR
The large areas of the ceiling which function as distribution plates for the Multi-Vent panels are heated or cooled to the temperature of the supply air.

See SWEET's Arch. & Eng. files or write for detailed literature.

MULTI-VENT DIVISION **THE PYLE-NATIONAL COMPANY**
1373 North Kostner Avenue Chicago 51, Illinois

AMERICAN-Standard

First in heating...first in plumbing



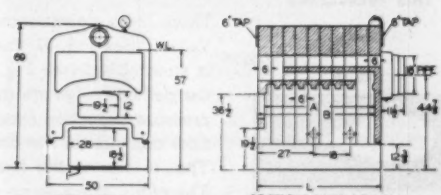
13 AMERICAN-Standard WATER TUBE BOILERS heat 276 unit project

● One of the Northwest's finest court-type housing projects is Portland's attractive Binford. Privately owned by Mr. L. C. Binford, this 276 unit residential community is as modern as you'll find anywhere. And, of course, American-Standard products play an important role in keeping it so!

The entire heating system of this large project is dependably fired by 13 oil fired No. 36 Water Tube Boilers. Installed in most instances in batteries of two, they are doing an efficient, economical job of keeping all units in this many-family community snugly warm and comfortable.

The selection of American-Standard heating equipment for this development is just another example of the tremendous preference that exists among builders, owners, architects and engineers for all products bearing the famous American-Standard name.

These boilers and other top quality heating equipment by American-Standard are sold through selected wholesale distributors to heating and plumbing contractors. **American Radiator & Standard Sanitary Corporation,** P. O. Box 1226, Pittsburgh 30, Pa.



American-Standard Water Tube Boilers are made in a wide range of sizes so that, either single or in battery, they meet the heating requirements of any type of building. The diagrams above are front and sectional views of No. 36 Water Tube Boiler. In the sectional diagram, dimensions indicated are: (A)—from 29½" to 65½". (B)—32¾" to 68¾". (L)—36" to 72".

LOOK FOR THIS MARK OF MERIT

Serving home and industry

AMERICAN-STANDARD · AMERICAN BLOWER · CHURCH SEATS · DETROIT LUBRICATOR · KEWANEE BOILERS · ROSS HEATER · TONAWANDA IRON

HOLDS THE PRESSURE SETTING VERY *Accurately . .*

CASH STANDARD *Streamlined* TYPE 1000 PRESSURE REDUCING VALVES

THE "Type 1000" Valve gives users absolute control of pressures. The reduced pressure is held constant regardless of variations in the initial pressure or variations in demand.

FIG. 1

YOU DON'T GET THIS TURBULENCE

FIG. 2

YOU GET THIS STREAMLINED FLOW

This operating feature eliminates all chance of changes occurring in the processing or of damage to product.

When there is peak demand to be met, your "1000" Valve is easily able to do it, holding the pressure constant at the same time.

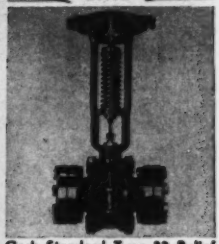
There is no downstream turbulence in your "1000" Valve. (See Fig. 1). The flow of steam, air, oil, etc. is streamlined (see Fig. 2) for straight flow through the delivery passage and jet. All of the process of pressure reduction occurs where the valve throttles flow and not on the downstream side of the valve. That is one of the feature results of streamlining. Therefore, there is no downstream turbulence and you have close delivery pressure control at all times.

Write for Bulletin "1000"

CASH STANDARD CONTROLS . . VALVES

A. W. CASH COMPANY
DECATUR, ILLINOIS

OTHER VALVES *from the* CASH STANDARD LINE



Cash Standard Type 33 Relief Valve; in various metals to handle nearly all fluids. Has Roller guides on valve spindle; also roller bearing to take care of spring torsion. Sizes ½" to 3" screwed ends; 1" to 12" flanged ends. Bulletin 971.

Cash Standard Type Q Relief Valve has side inlet, bottom outlet. Popular for pump by-pass use. Sizes ½" to 2" screwed ends. Relief pressures up to 350 lbs., temperatures up to 500°F. Bulletin 943.

Cash Standard Type 4190 Valve for relief (bypass) use; holds constant valve inlet pressure regardless of changes in load or outlet pressure. Multiport—large capacity. Iron or bronze bodies; iron or bronze trim. Sizes ½" to 2" screwed ends; 2" to 6" flanged ends. Bulletin 952.

SAVE 54% IN LABOR TIME!

when you install BURNHAM BASE-RAY with the Series Loop System

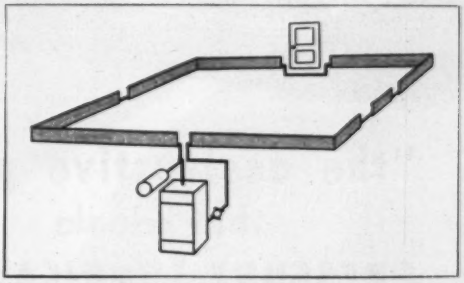
The low, sweeping lines of BASE-RAY add beauty to any room and make this method of heating particularly appealing to women.

When you can save more than half the cost of labor on a piping installation—*that's saving!* It means too that available man power can be spread over more jobs! And when you deliver a modern Burnham BASE-RAY* Radiant Baseboard System the combination is *unbeatable.*

It will really pay you to use this modern system, proven by hundreds of successful installations over a 6-year period. Although it is equal in performance, efficiency and rapid response to conventional one-pipe forced circulation systems there are *other important savings.* Here's the score: 40% less pipe is used . . . No swing joints are used . . . Fittings are cut in half . . . Man hours on piping installation are cut by 54%.

The figures cited compare a conventional one-pipe forced circulation system with a Series Loop System in a 1-story basementless house. Comparable savings are made in other types of houses.

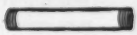
*Reg. U. S. Pat. Off.



The Series Loop System shown here, with BASE-RAY forming part of the main, is ideal for ranch type or basementless houses. Full details of this materials-and-labor saving hook-up will be found on page 10 of the IBR Installation Guide No. 5. It can be used with comparable results in the 2-story house with basement.

CUTS PIPE USE 40%

BASE-RAY Radiant Baseboards as part of the main in the Series Loop System—a substantial saving in a mighty scarce item.



REDUCES USE OF FITTINGS 49%

Omitting swing joints, valves and other fittings to a minimum, the Series Loop means BIG Savings.

BASE-RAY WEARS LIKE IRON . . . FOR IT IS MADE OF IRON

Burnham Corporation

"PIONEERS OF RADIANT BASEBOARD HEATING"

IRVINGTON, N. Y., Dept. HP-111

MAIL COUPON TODAY

Dept. HP-111

BURNHAM CORPORATION, Irvington, N. Y.

Please send me folders checked below:

☐ New 6-page BASE-RAY folder ☐ BASE-RAY Ratings and Installation Guide

Name .....

Address .....

City ..... State .....

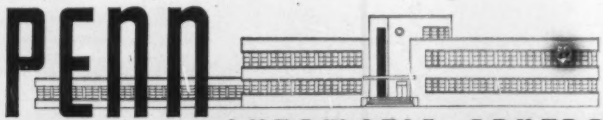
"the destructive pair" that cripple PRESSURE-LUBRICATED COMPRESSORS

It's a sad story when either of "the destructive pair" . . . low oil pressure or slow pickup of oil pressure . . . go to work on a pressure-lubricated compressor. When that happens, damage to seals and bearings may result, even in the best of refrigeration compressors.

But, you can stop "the destructive pair" from their crippling work with the new PENN Series 275 Oil Protection Control with built-in Time Delay Switch.

Here's how it works. When compressor starts, if the oil pressure does not build up to the proper point within a safe time period, the PENN 275 stops the compressor *automatically* before damage can occur. If oil pressure drops below a safe minimum during the running cycle . . . and does not rise to normal within the time delay period . . . the control stops compressor operation. Thus, the compressor never operates more than the predetermined safe time on subnormal oil pressure. Result? Positive, automatic protection at all times!

Investigate this new, low-cost protection for refrigeration compressors or for other pressure-lubricated equipment. For complete information ask your compressor manufacturer or wholesaler or write **Penn Electric Switch Co., Goshen, Indiana.** Export Division: 13 E. 40th Street, New York 16, N. Y., U. S. A. In Canada: Penn Controls Limited, Toronto, Ontario.



AUTOMATIC CONTROLS

FOR HEATING, REFRIGERATION, AIR CONDITIONING, PUMPS, AIR COMPRESSORS, ENGINES, GAS RANGES

IT ALWAYS PAYS TO SPECIFY

LADISH

Controlled Quality

PIPE FITTINGS

TO MARK PROGRESS

...where flow efficiency is a vital factor

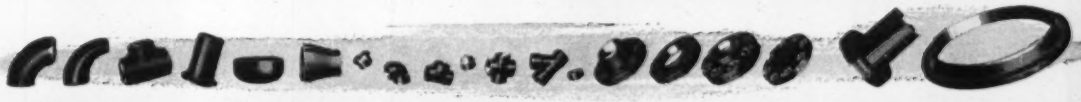
You can depend on Ladish Controlled Quality Fittings to maintain maximum flow characteristics of any piping system . . . and do it consistently year after year. For advanced Ladish engineering assures the true circularity, full effective radii and smooth inner surfaces necessary to keep turbulence and friction loss at a minimum . . . features which are doubly safeguarded by the high, inflexible standards of Ladish Controlled Quality.

THE COMPLETE *Controlled Quality* FITTINGS LINE
PRODUCED UNDER ONE ROOF...ONE RESPONSIBILITY

LADISH CO.

CUDAHY, WISCONSIN
MILWAUKEE SUBURB

District Offices: New York • Buffalo • Pittsburgh • Philadelphia • Cleveland • Chicago • St. Paul
St. Louis • Atlanta • Houston • Tulsa • Los Angeles • Havana • Toronto • Mexico City



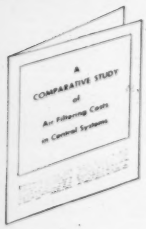
is as bad as dirty filters!

What! Board up the air conditioning? That's ridiculous. But you get just about the same effect when you let dirt-choked air filters remain in your unit. You block off air flow, cut your comfort and raise your operating costs.

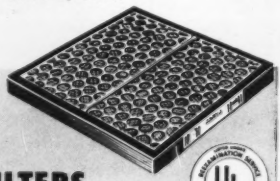
Regular, periodic replacement of filters is *essential* if you want to get good air conditioning and avoid costly repairs. How often should you replace them? As often as they get dirty . . . and that depends on local conditions . . . in some cases as often as once a month.

Be sure your filter replacement is handled on a definite schedule, using nationally known and accepted Fiberglas DUST-STOP* Air Filters, the replacement filters that provide high dirt-catching capacity at low cost.

Your DUST-STOP supplier can help you set up a way of handling filters systematically. Discuss it with him today. Owens-Corning Fiberglas Corporation, Dept. 40-K, Toledo 1, Ohio.



Get this Booklet—The "Comparative Study of Air Filtering Costs" contains facts, figures and charts important to anyone interested in air conditioning. A copy free on request. Write today.



OWENS-CORNING FIBERGLAS

DUST-STOP* AIR FILTERS

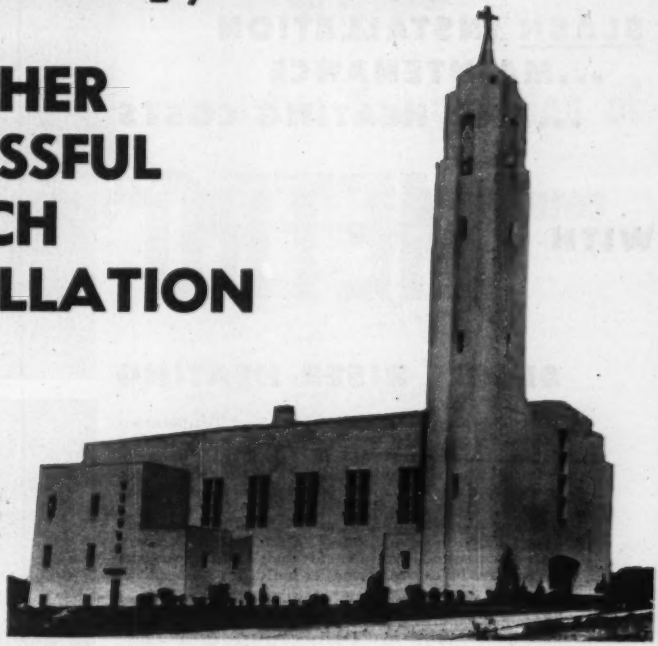
*T. M. REG. U. S. PAT. OFF.

*DUST-STOP is the trade-mark of Owens-Corning Fiberglas Corporation for impingement type air filters made of glass fibers. FIBERGLAS is the trade-mark (Reg. U. S. Pat. Off.) of Owens-Corning Fiberglas Corporation for a variety of products made of or with fibers of glass.

WARM AIR HEATED...

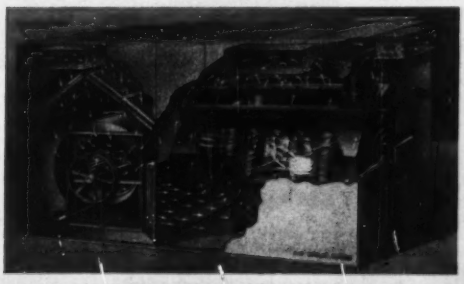
by Campbell

ANOTHER SUCCESSFUL CHURCH INSTALLATION



Catholic Cathedral, Bismarck, N. D. Heated since 1942 with 2 gas-fired Campbell 8000 Units. William F. Kurke, Architect, Fargo, N. D.

Increasing numbers of architects, engineers and contractors are specifying Campbell Warm Air heaters for large church buildings. There are many reasons for this growing favor. Campbell Heaters are easy to install. They provide fast heat delivery; positive control of temperature, humidity and ventilation; quiet operation and outstanding fuel economy. Easily adaptable for summer air conditioning. Available for all fuels in capacities up to 2,160,000 BTUs.



SPECIAL UNITS FOR DRYING & PROCESSING

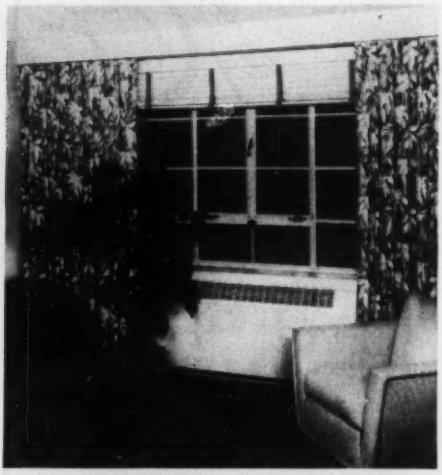
We build direct oil and gas-fired units up to 14,000,000 BTUs.

CAMPBELL HEATING COMPANY

P. O. BOX 833 · DES MOINES 4, IOWA

IN STUYVESANT TOWN

Handsome "Metro" cabinet convector with "Metro" downfeed single riser behind draperies keeps rooms comfortable—*for less*—in Stuyvesant Town, N. Y.



SLASH INSTALLATION ...MAINTENANCE ...AND HEATING COSTS WITH "METRO"

SINGLE RISER HEATING

"Metro" piping with Dunham Vari-Vac* Temperature Controls keeps heat supply and demand in perfect balance . . . *always* . . . and for less. That's because "Metro" uses a *continuous* flow of steam at pressures and temperatures that *automatically vary with outside weather.*

Metropolitan, Equitable, and New York Life Insurance Companies have found "Metro" with Dunham Vari-Vac a sound investment for their housing projects . . . so have investors in smaller buildings . . . because:

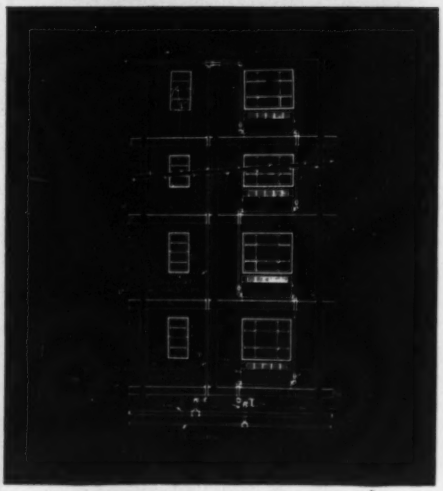
"METRO" costs less to install. It eliminates all radiator branches, expansion joints, and swing connections—no traps and valves in occupied quarters. Permits precutting of risers to one size. Eliminates settings for temporary heat. Eliminates costly furring of masonry walls and ceilings.

"METRO" costs less to maintain. No small radiator fittings to break down. Eliminates *all* cost of valve maintenance—90% of trap maintenance.

"METRO" costs less to operate. Used with Dunham Vari-Vac Controls, fuel savings as high as 40% are not at all uncommon. "Metro" never is guilty of overheating or underheating.

See your Dunham Sales Engineer for complete information—or write for Bulletin 2202-2. No obligation.

**Variable Vacuum*



IN ANY TOWN

"Metro" single riser heating provides an uninterrupted path for flow of steam from top to bottom of building. A continuous pipe passes down through overlying rooms . . . is offset into a convector or baseboard in each room.

Send for Free Bulletin 2202-2. Full of helpful information about this amazingly economical heating system. Includes all essential design details, application data, and typical piping hookups.

DUNHAM

heating systems and equipment

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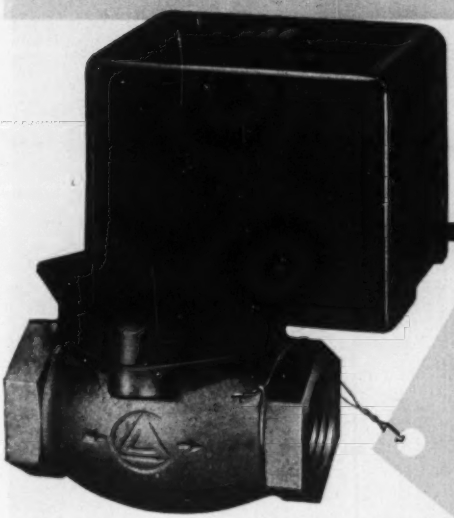
Radiation • Unit Heaters • Pumps • Specialties

demand

DETROIT CERTIFIED CONTROLS



This Exclusive Combination of DETROIT Features

V-579 "BI-FLEX" GAS VALVE

★ Quiet operation—no click, no hum. An ideal replacement for noisy valves.
★ Rugged, compact design—easy to service.
★ Inexpensive.
★ Adaptable to all gases.
★ "Bi-flex" motor operated—low voltage.
★ Temperature and voltage compensation.
★ Snap-action opening and positive closing.
★ ½ inch to 1¼ inch sizes.

The exclusive features of the V-579 "Bi-flex" Gas Valve prove that you get more for your money when you deal with DETROIT. You can always count on giving your customers a better job when you install any DETROIT control. DETROIT controls are designed and built to fill your customers' needs—to give real economy and reliability through years of trouble-free service. The V-579, for example, at low initial cost, gives your customers an exclusive combination of outstanding features which provide new standards for the efficient and quiet operation of modern gas burning equipment. And that's exactly the kind of operation that pays off with more comfort for the user, more sales and profits for you. So take advantage of this extra value—insist that your source of supply furnish DETROIT controls with all your heating equipment. Write for Bulletin No. 229.

Means More Comfort for your Customers

More Profits for You!

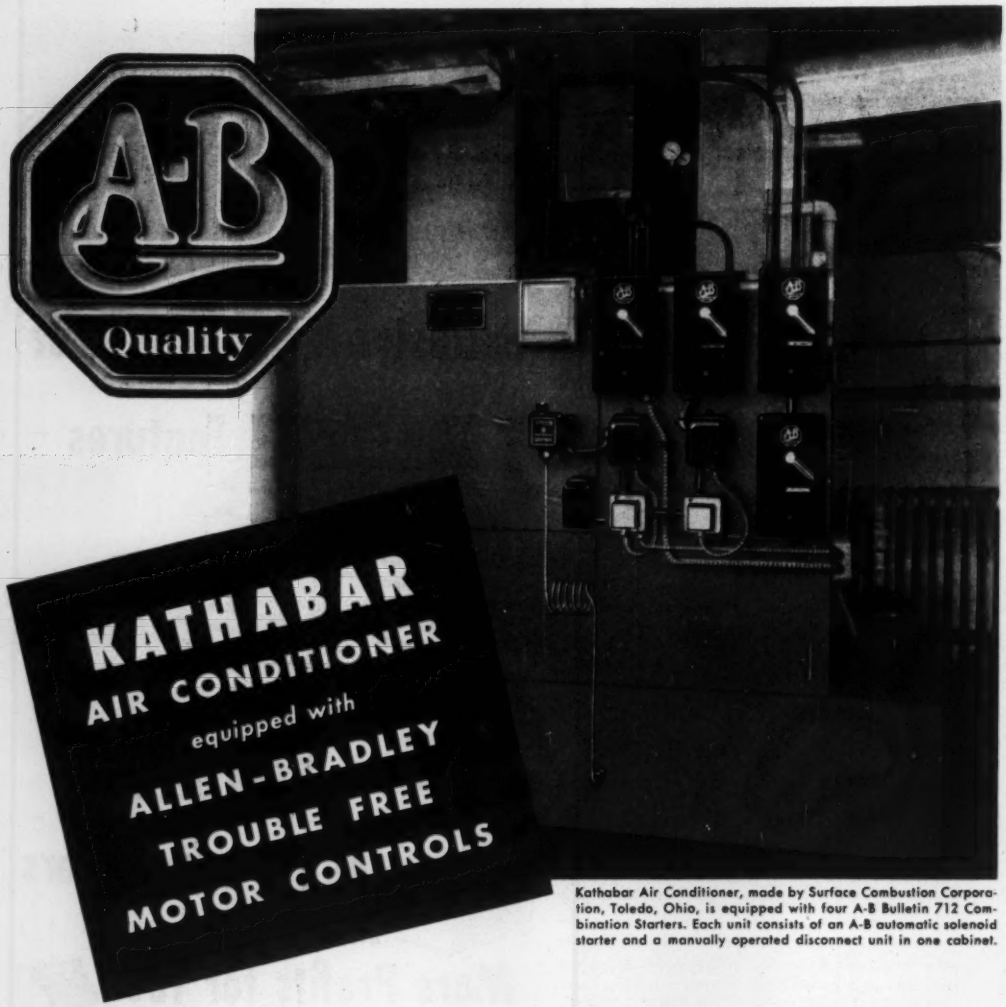
No. 411 Thermostat—A sensitive and accurate *Timed Cycling* thermostat for all types of heating systems. Provides close control of room temperature. Attractively styled, easily installed and adjusted. Write for Bulletin No. 193 and Form No. 1545.

DETROIT LUBRICATOR COMPANY

3900 TRUMBULL AVE., DETROIT 8, MICHIGAN
Division of AMERICAN RADIATOR & Standard Sanitary CORPORATION
RAILWAY & ENGINEERING SPECIALTIES, LTD.
Canadian Representatives in Montreal, Toronto, Winnipeg.

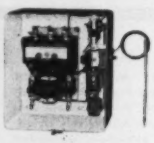
DETROIT HEATING AND REFRIGERATION CONTROLS • ENGINE SAFETY CONTROLS • FLOAT VALVES AND OIL BURNER EQUIPMENT • DETROIT EXPANSION VALVES AND REFRIGERATION ACCESSORIES • STATIONARY AND LOCOMOTIVE LUBRICATORS

Serving home and industry: AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILERS • RUUD HEATER • TONAWANDA IRON



Kathabar Air Conditioner, made by Surface Combustion Corporation, Toledo, Ohio, is equipped with four A-B Bulletin 712 Combination Starters. Each unit consists of an A-B automatic solenoid starter and a manually operated disconnect unit in one cabinet.

A-B Special Refrigeration Control Unit



Allen-Bradley offers a wide line of special refrigeration control panels . . . all the necessary controls in one enclosure. Pressure and temperature controls, manual and automatic starters are mounted on one panel.

A-B Bulletin 712 Combination Starter

Bulletin 712, Size 1, Combination Starter with fuse clips in pressed steel enclosure. A-B Combination Starters reduce installation time, save space, result in a neater wiring job, and provide extra safety. Trouble free.

Why are Allen-Bradley automatic starters so popular for refrigeration and air-conditioning service? . . . Because they are trouble free. Only ONE moving part. No pivots, pins, or bearings to corrode or stick . . . no jumpers to break. You install them . . . and forget them!

No contact maintenance . . . Allen-Bradley patented silver alloy contacts never need cleaning, filing, or dressing.

Dependable overload relays . . . Allen-Bradley thermal relays are accurate and always dependable . . . even after long service.

The Allen-Bradley trademark stands for millions of trouble free operations.

Allen-Bradley Co.
1335 S. First St., Milwaukee 4, Wis.

ALLEN-BRADLEY SOLENOID MOTOR CONTROLS

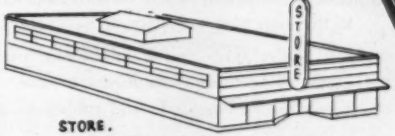
NOTES FROM AN ENGINEER'S SKETCH PAD

LOOKS LIKE THAT VERSATILE DRAVO "COUNTERFLO" HEATER CAN BE USED ON PRACTICALLY ALL OUR JOBS.

SCHOOL DISTRICT BUDGET LIMITED. CAN SAVE WITH DRAVO HEATERS.

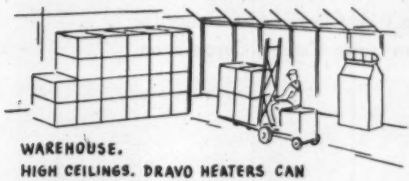
CHURCH. INTERMITTENT HEATING. NEEDS QUICK PICK-UP. DRAVO HEATER CAN DO.

ARMY BASE.
WINTER CONSTRUCTION ON THESE BARRACKS. CAN INSTALL DRAVO HEATERS EARLY FOR HEAT DURING CONSTRUCTION AND AFTER COMPLETION.

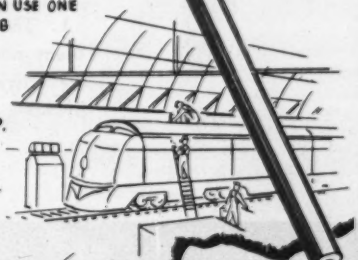


STORE.
WITH DRAVO HEATERS, CAN USE ONE SET OF DUCTS FOR HEATING AND AIR-CONDITIONING.

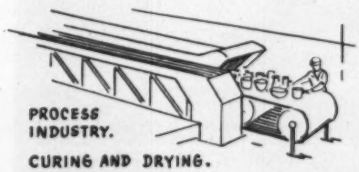
INDUSTRIAL PLANT.
DRAVO HEATERS HAVE 150' AIR THROW. NO DUCTS NEEDED.



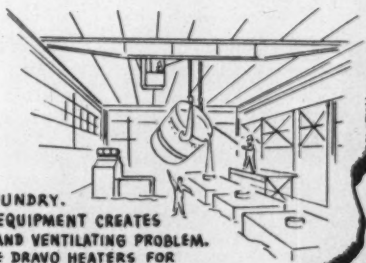
WAREHOUSE.
HIGH CEILINGS. DRAVO HEATERS CAN REDUCE ROOF HEAT LOSS, KEEP HEAT WHERE IT'S NEEDED.



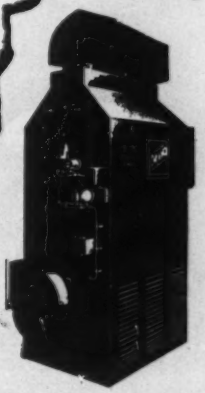
DIESEL RAILROAD SHOP.
NEEDS HEAT AT WORKING LEVEL. DRAVO HEATERS IDEAL.



PROCESS INDUSTRY.
CURING AND DRYING. SPECIFY DRAVO HERE.



FOUNDRY.
EXHAUST EQUIPMENT CREATES HEATING AND VENTILATING PROBLEM. USE DRAVO HEATERS FOR TEMPERED "MAKE-UP" AIR.



A case study on any [illegible] installations is yours for the asking. For complete information on how Dravo "Counterflo" Heaters can help solve your heating problems, write for Bulletin LM-526-35

DRAVO CORPORATION

HEATING DEPARTMENT, DRAVO BUILDING, PITTSBURGH 22, PA.

PITTSBURGH • CLEVELAND • PHILADELPHIA • DETROIT • NEW YORK • CHICAGO • ATLANTA • BOSTON

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Who's thinking of you?

The men in our shops know what it's like to install and service air conditioning. They know the kind of jobs you run into. That's why these engineers of ours have tried to make your job just as easy as possible.

Take our System Weathermaker*, for instance. We've built it with you in mind.

It's built in sections. That makes it easier to handle. And more convenient to install, horizontally or vertically. Fan, cooling coil, heating coil, by-pass and filter sections—they can all be arranged as you like. You can make your coil connections from either end.

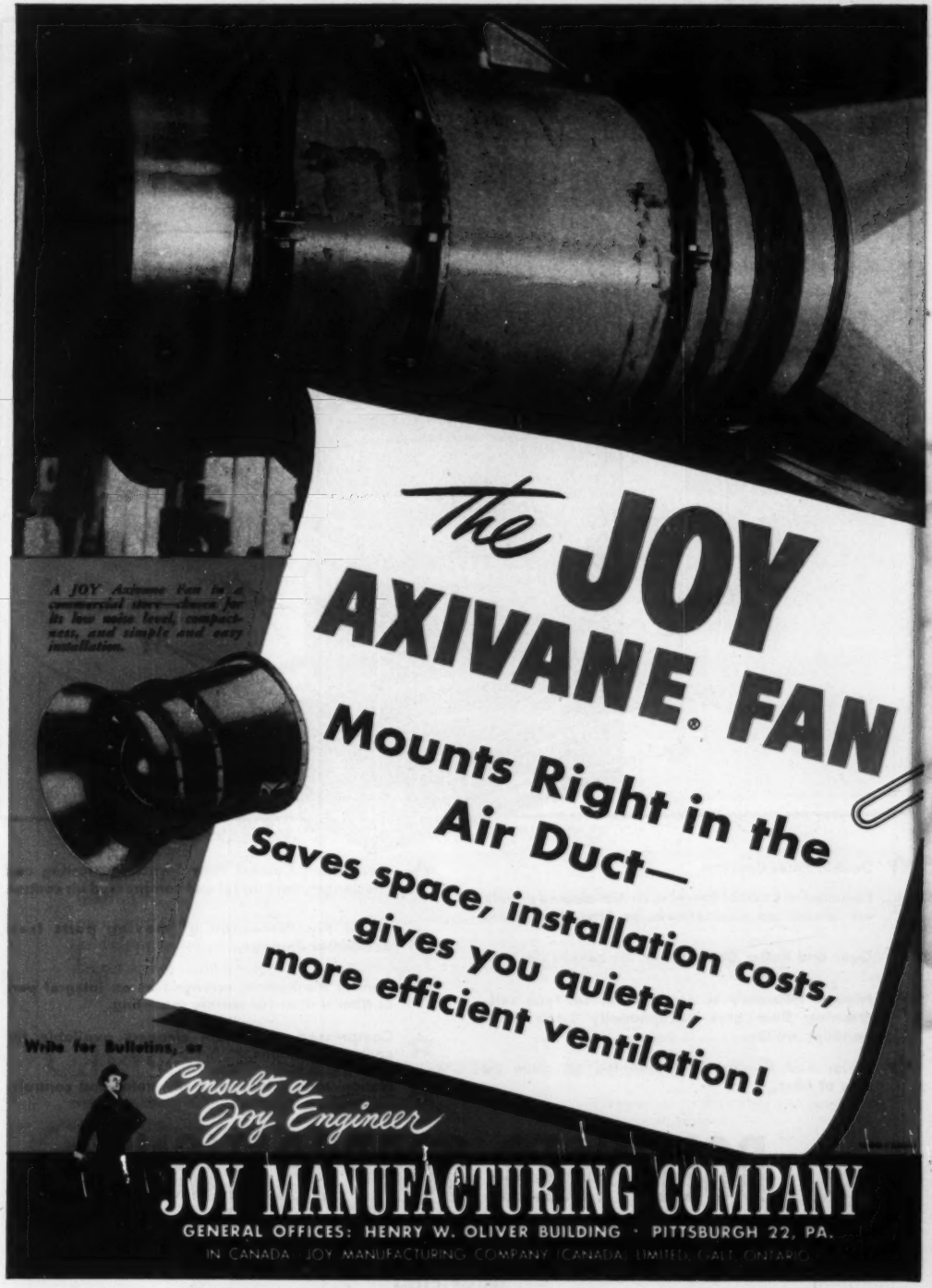
Then, too, we've designed new fans and put the coil on an incline. This puts more coil surface to work and we can cut down on the size and weight of the unit without cutting down on the job it does. So the System Weathermaker weighs less. That's important to the man who has space or structural limits.

We've made this Weathermaker easy to service, too. You can reach all sections without any trouble. There's no sweating—our insulation sees to that. And rubber paint fights off rust.

There's a Carrier Weathermaker for every air conditioning job. The cfm range goes from 1000 to 16,400 in single units. Want more information? Look in your Classified Directory for the Carrier dealer nearest you, or write Carrier Corporation, Syracuse 1, New York.

*Reg. U. S. Pat. Off.

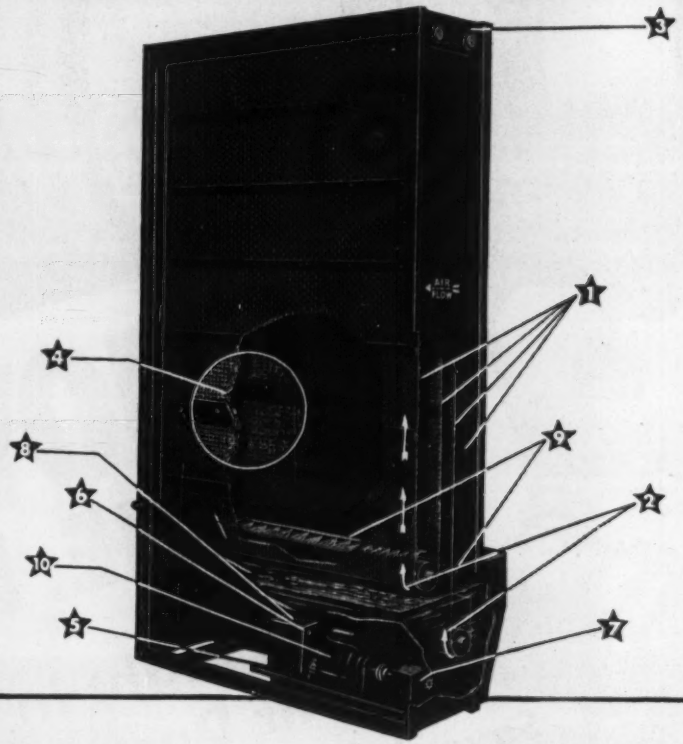
This is the Carrier System Weathermaker, 1000 to 16,400 cfm in single units. Available also in Model 39T horizontal type.


the JOY
AXIVANE® FAN
Mounts Right in the Air Duct—
Saves space, installation costs, gives you quieter, more efficient ventilation!
A JOY Axivane Fan in a commercial store—chosen for its low noise level, compactness, and simple and easy installation.
Write for Bulletins, or
Consult a Joy Engineer
JOY MANUFACTURING COMPANY
GENERAL OFFICES: HENRY W. OLIVER BUILDING · PITTSBURGH 22, PA.
IN CANADA: JOY MANUFACTURING COMPANY (CANADA) LIMITED, GALT, ONTARIO

STAYNEW AUTOMATIC

No other Air Filter can give you these

10 IMPORTANT FEATURES

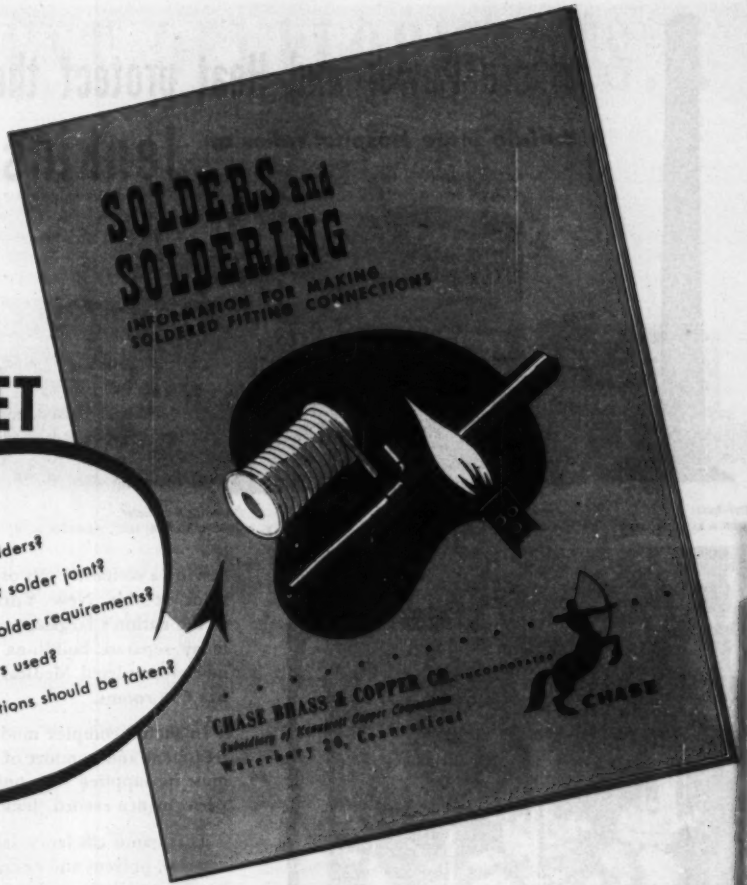


1. **Double Filter Curtains.**
2. **Direction of Curtain Travel such that *cleaned* panels are *always* on downstream or filtered air side.**
3. **Gear and Roller Chain Drive. *No belts to slip.***
4. **Highest Efficiency of any mechanical type self-cleaning filter plus exceptionally large dust-handling ability.**
5. **Motor and Control Unit mounted on *clean* air side of filter.**
6. **Momentary Contact Time Switch for testing and checking curtain travel and compressed air control.**
7. **Shear Pin Protection of moving parts from accidental damage.**
8. **Control Mechanism arranged as an integral part of filter unit or for remote mounting.**
9. **Compressed air curtain cleaners available for special conditions.**
10. **Nation-wide Service on both motor and controls.**

DOLLINGER CORPORATION

9 CENTRE PARK DOLLINGER PROTECTOMOTOR STAYNEW FILTERS ROCHESTER 3, N. Y.

NEW FREE BOOKLET



- When do you use soft solders?
- How do you make a soft solder joint?
- How do you estimate solder requirements?
- When are hard solders used?
- What cooling precautions should be taken?

Answers your questions about solders and soldering

Because of a constant demand for information on soldering procedures, equipment and other useful data, Chase Brass and Copper has published this new booklet on solders and soldering information.

It answers many questions on the choice of solder alloys, fluxes, soldering methods, quantities required and tools and other equipment needed. Send coupon below for your *free* copy today.

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CHASE 75th ANNIVERSARY 1876 1951

FREE Booklet gives practical information on types of solders and making solder joints.

Chase Brass & Copper Co., Dept. HPA 1131
Waterbury 20, Conn.

Please send me your FREE *new booklet on* SOLDERS AND SOLDERING.

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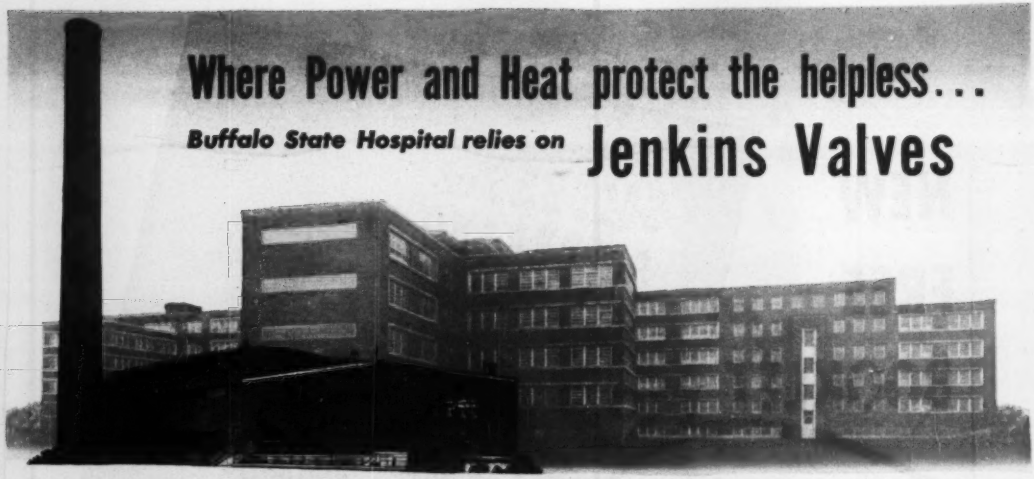
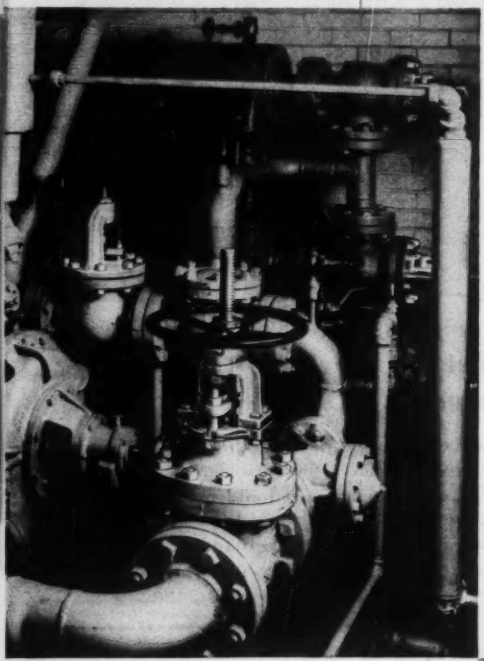
Where Power and Heat protect the helpless...

Buffalo State Hospital relies on Jenkins Valves



Architects: YORK & SAWYER, NEW YORK
General Contractor: THE JOHN W. COWPER CO., INC., BUFFALO, N. Y.
Plumbing Contractor: GEO. H. DRAKE, INC., BUFFALO, N. Y.
Heating Contractor: QUACKENBUSH CO., INC., BUFFALO, N. Y.



Among the 1100 Jenkins Valves in the new Power House at the Buffalo, N. Y., State Hospital are these in the prefabricated pump heater set. More than 875 others control steam, water, fire, air conditioning and other vital pipelines in the new Medical and Surgical Building.

Serving a veritable "city of patients", the new power plant at this New York State Institution, one of the nation's largest, provides heat and power for many separate buildings. One building alone, the newly-completed Medical and Surgical unit, has 698 rooms.

In such a complex modern "plant" for the treatment and comfort of patients, power and heat must be supplied with unfaltering *efficiency*. On their performance record, Jenkins Valves were chosen.

This same efficiency is essential to operating *economy*, present and future, in *all* buildings served by power installations. That's why Jenkins Valves have been the choice, consistently, for so many of the notable new plants and buildings arising throughout the nation.

Jenkins builds *extra* endurance into valves — proved by low upkeep cost records in power plants both large and small. Yet, despite this *extra* value, *you pay no more* for Jenkins Valves. For new installations, for all replacements, let the Jenkins Diamond be your guide to lasting valve economy. Jenkins Bros., 100 Park Ave., New York 17. Jenkins Bros., Ltd., Montreal.

SOLD THROUGH LEADING INDUSTRIAL DISTRIBUTORS EVERYWHERE

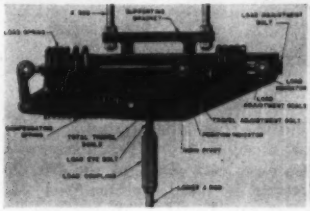
JENKINS
LOOK FOR THE DIAMOND MARK
VALVES

EQUIPMENT DEVELOPMENTS...

For your convenience in obtaining more information about any of this equipment, see coupon on this page. Add the new products and companies listed here to your Directory Section which you received in your January 1951 Heating, Piping & Air Conditioning and thus keep your records of sources of supply up to date throughout the year. Single asterisk indicates equipment not listed in Directory Section; double asterisk, equipment and manufacturer not listed.

Constant Support Hanger

HPAC 1—Improved Model L constant support hanger providing simplified field adjustment, increased travel range and greater load capacity with a smaller number of springs and fewer chassis sizes— Grinnell Co., Inc., 260 W. Exchange, Providence 1. Three new refinements include a hanger structure designed for center support which places equal dimensions on each side of the center supporting line, non-resonance in the springing system, and provision to give less horizontal shift of the load line as the load shifts from cold to hot positions. Maximum travel has been increased to 5 in. in the medium chassis and 10 in. in the large chassis. The total load range is now covered by 16 sizes, with overlapping of load and travel ranges from size to size. Discrepancies between calculated and actual hanger loads can be field corrected by adjusting the position of one nut, since the compensating spring requires no adjustment with a change of load setting.



Hanger

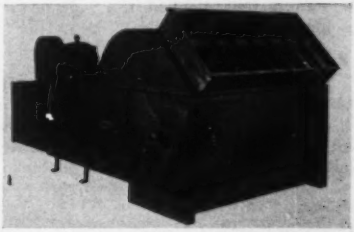
Wirefeed Device

Wirefeed Welding Device

HPAC 2—Automatic wirefeed device, "Fillerweld," to be used with gas shielded arc welders, allows operator to control flow of filler metal (without breaking the arc) by means of a finger switch mounted on the torch—General Electric Co., Welding Department. Schenectady 5. The gun is a manual water cooled inert arc tungsten holder with a control switch and a gear assembly for pulling the filler metal from spool to arc. Rated at 250 amp, the gun accommodates tungsten from 0.040 to 5/32 in. in diameter, and up to 7 in. long. The power unit consists of a motor, a "Thy-mo-trol" unit for controlling it, and a spool which holds the filler wire. The operator presets the desired filler wire speed by means of a rheostat. The device can best be used on stock less than 3/16 in. thick, but if speed is not paramount, it will produce a high quality weld on thicker material, the manufacturer states.

Multi-Zone Air Conditioning

HPAC 3—Zoning "Weathermakers" for providing independent control of air conditioning in separate areas of multi-room buildings through a central system—Carrier Corp., 302 S. Geddes St., Syracuse 1. Five sizes range in capacity from 12 to 58 tons. With the factory built



damper section, there can be 5, 7, 10 or 14 zone control. Units are of the horizontal blowthrough type. Damper control for separate zones is provided through a double outlet arrangement, with one outlet supplying cooled and dehumidified air and the other, warm air. Outlets are divided into separate dampering compartments. An independently operated double damper in each twin compartment regulates the proportion of warm and cool air for the zone, shutting down one as the other is increased.

FOR YOUR CONVENIENCE [11-51]

Heating, Piping & Air Conditioning
6 N. Michigan Ave., Chicago 2, Ill.

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in Equipment Developments and Recent Trade Literature

(Circle each HPAC number in which you are interested)

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
101	102	103	104	105	106	107	108	109	110
111	112	113	114	115	116	117	118	119	120
121	122	123	124	125	126	127	128	129	130
131	132	133	134	135	136	137	138	139	140
141									

Name ..... Title .....

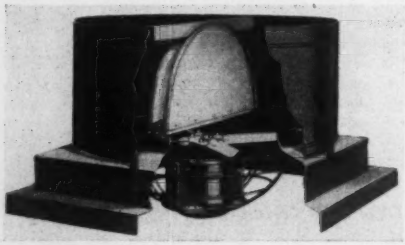
Company .....

Address .....

City ..... Zone ..... State .....

Roof Ventilator

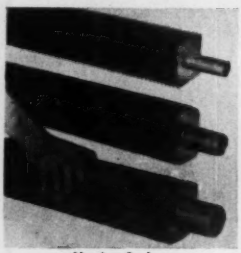
HPAC 4—"Whirlout" powered roof ventilator, of the straight-through type, with simplified design and low overall height—The Swartwout Co., 18511 Euclid Ave., Cleveland 12. The ventilator is open only when its propeller



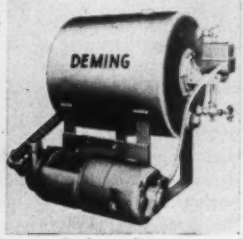
fan is operating, the air stream being utilized to open and hold two semi-circular halves of the damper while forcing unwanted elements out of the building. A fan ring directly above the square tipped blade propeller guides the airstream. The unit is supplied in a wide range of sizes and capacities.

Finned Radiation Surface

HPAC 5—Heating surface (for commercial, industrial or institutional heating) constructed with 1¼ or 2 in. standard size steel pipe—Bush Mfg. Co., 179 South St., West Hartford, Conn. The surface is also constructed of heavy wall, 1⅛ in. OD copper tubing, with aluminum fins.



Heating Surface



Condensate Return

Condensate Return Units

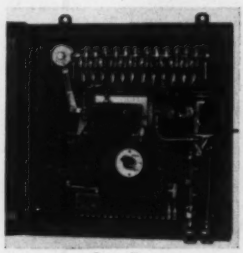
HPAC 6—"Motor-Mount" units designed to save fuel by returning condensate from steam coils, radiators, or steam operated equipment back to the boiler—The Deming Co., 14 Aetna St., Salem, Ohio. Centrifugal pumps used with the units have enclosed type bronze impellers and stainless steel shafts, and are mounted on the legs of the tank, so that no base is required. The motor has a standard NEMA type C mounting flange and is furnished for single phase, two or three phase, or direct current. The line includes single units (pump, motor, storage tank, suction piping, float switch and water level gage) and duplex units (two pumps, two motors, one storage tank, one alternator switch and one water level gage) for requirements in excess of the capacity of a single unit, or for standby operation. The 44 units in both types are designed to handle from 2000 to 40,000 sq ft of radiation.

Cast Steel Valves

HPAC 7—Series 1500 small cast steel Y globe and angle type valves for high pressure service—Walworth Co., 60 E. 42nd St., New York 17. Valves are rated at 1500 psi-950 F for steam, 3600 psi-100 F for water, oil and gas. Body and yoke are one casting, eliminating need for a bonnet joint. The only weld used is for securing seat ring to body. The design incorporates a rotating disc held on a stem by steel balls enclosed in a groove (which is so designed that stress occurs on the steel balls only during the opening cycle). Standard sizes range from ¼ to 2 in.

Controller for Refrigeration Compressors

HPAC 8—"Step Controller" for controlling multiple stages of refrigeration capacity by starting and stopping compressors in sequence, loading and unloading cylinders, or a combination of both — Johnson Service Co., 507 E. Michigan St., Milwaukee 2. It is available in 4, 6, 8 or 12 switch models. Each single pole, double throw switch is operated by a pair of cams on a shaft which is rotated by a pneumatic piston in response to a pneumatic temperature or pressure measuring instrument. "On" and "off" points of each switch are individually adjustable over the entire range of operation. Several different springs are available for the piston, which also may be equipped with a pilot positioner. A current failure solenoid, which exhausts air from the piston, returns all switches to normal position whenever the current is interrupted.



Controller

Fan

Fan for Corrosive Fumes

HPAC 9—Fan for expelling corrosive fumes, with blades, housing, bolts, nuts, etc., made of the No. 20 stainless steel manufactured by The Carpenter Steel Co., Union, N.J.—Clarage Fan Co., Porter St., Kalamazoo 16. The wrought material is designed to resist sulphuric and nitric acids and their fumes.

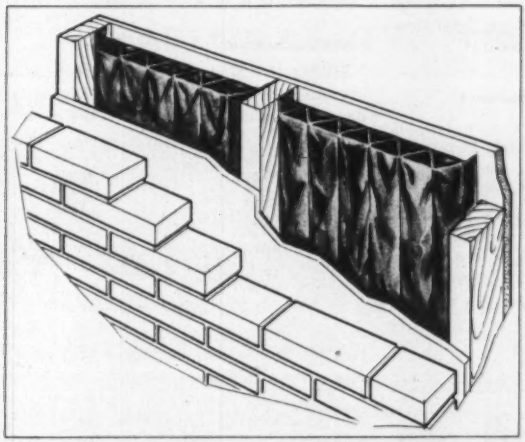
Gas Burner

HPAC 10—"Rectilinear" gas burner which provides high input through narrow rectangular openings — Webster Engineering Co., P.O. Box 2168, Tulsa 1. Initial units were fabricated for inter-tube firing of a 95,000 lb per hr generator. Applications may be made at pressures as low as 1 psig, and the unit will modulate to 4 oz without flashback, the manufacturer states. Small and lightweight, it can be used for firing in a horizontal plane through firedoors or small openings over handfired coal grates, for firing in a vertical plane on either side of a stoker or oil burner, for firing in a horizontal plane over oil burners or stoker hoppers, etc.

Heat Pump Demonstration

HPAC 11—Demonstration of radiant panel heating and radiant cooling by use of the heat pump principle —

METALS ARE THE BEST INSULATORS



AGAINST HEAT AND COLD IN BUILDING SPACES

Ordinary iron is about 4 times better insulation in an air space than sheepswool, rockwool, asbestos, asphalt paper, brick, plaster, wood, marble, slate, tile, enamel. *Aluminum, brass, gold, silver, and many other metals are 40 times better.*

SPACE has slight density, therefore heat flow by CONDUCTION is slight. CONVECTION, which causes 15%-20% heat flow in space sideways, and 25% to 40% upwards, is BLOCKED by metals in space. RADIATION, responsible for 65% to 85% heat flow in space sideways and 55% to 75% upwards, is absorbed and emitted least by metal surfaces; from 1% to 5% with aluminum, brass, gold, silver; but over 90% with most building materials, including ordinary insulations.

Multiple sheets of metal, suspended in space, and spaced apart, make the supreme heat and cold insulation. One commercial form of this construction is Infra Accordion Aluminum Insulation, Types 4, 6, and 4 Jr.

Write for interesting, informative, newly compiled, free
RADIATION AND ABSORPTIVITY CHART OF MOST BUILDING MATERIALS AND METALS
The facts contradict most people's preconceptions.

INFRA THERMAL FACTORS, TYPE 4

Up-Heat	C.134, R 7.46 = 3"	dry rockwool
Will-Heat	C.107, R 9.34 = 3¾"	dry rockwool
Down-Heat	C.065, R 15.38 = 6"	dry rockwool

INFRA INSULATION, INC.
10 Murray Street, New York, N. Y.
PHONE: CO 7-3833

INFRA INSULATION, INC.
10 Murray Street, New York, N. Y. Dept. H-11
Send FREE Radiation & Absorptivity Chart.

Name_____

Firm_____

Address_____

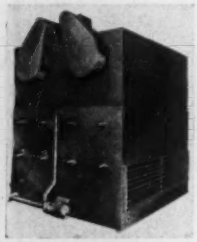
☐ Send Prices of Infra Insulations ☐ Send Sample

American Brass Co., 414 Meadow St., Waterbury 20, Conn. The demonstration is being conducted at the 7th All-Industry Refrigeration and Air Conditioning Exposition, Navy Pier, Chicago.

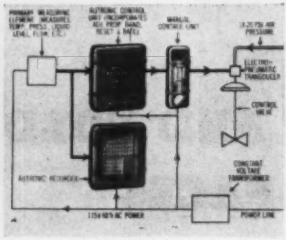
In addition, copper restrictor or capillary tubes, a copper refrigeration tube, and special formed parts of copper and aluminum are being displayed. Vibration eliminators of all sizes, made by the American Metal Hose Branch of the company, are exhibited as well.

Cooling Towers and Evaporative Condensers

HPAC 12—"LT" cooling towers in new sizes ranging in capacity from 105 to 225 tons in a single factory assembled unit, and "UL" evaporative condensers (illustrated) in new sizes ranging from 105 to 260 tons, with F-12 refrigerant—Baltimore Aircoil Co., Inc., 2519-23 Pennsylvania Ave., Baltimore 17. Casings are constructed of hot dipped galvanized sheets braced with hot dipped structurals. Both units are suitable for either indoor or outdoor installation. Condensers utilize either "Freon" or ammonia.



Evaporative Condenser



Control System

Electronic Control System for Process Variables

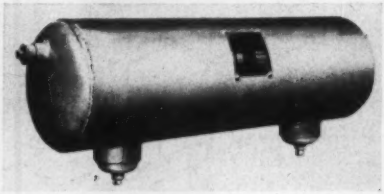
HPAC 13—"Autronic" automatic electronic instrumentation and control system for measuring and controlling process variables such as temperature, pressure, level and flow in processing plants, industrial power plants, and similar installations—The Swartwout Co., 18511 Euclid Ave., Cleveland 12. The primary sensing element generates a voltage (directly proportional to any change in the process variable) which is transmitted to the control unit where it is continuously modulated by electronic means, the resulting direct current being transmitted to the final control element which may be either electrically or pneumatically operated. The system operates on 115 volt, 60 cycle, alternating current.

Steel Pipeline Gate Valve

HPAC 14—Type 49 steel pipeline gate valve with body ports bored to match connecting piping — Walworth Co., 60 E. 42nd St., New York 17. Because there are no obstructions, liquid and scrapers or pigs may pass through freely. In addition, there are no recesses, and dirt cannot accumulate readily. No internal lubrication is required, and the valves may be installed without regard to flow direction. The disc mechanism is constructed in such a way that the lower portion of the disc accommodates the port aperture — of the same bore as the valve port — and the upper portion is utilized for making the shutoff. Two disc shield plates are centered over the seat rings and pressed axially against the discs, and any foreign matter which might enter the disc port when the valve was being closed would be retained between the shield plates and pass downstream when the valve was reopened. The valve is designed for service on crude and finished products and gas lines. It is available in sizes of 4 to 30 in.

Heat Exchanger

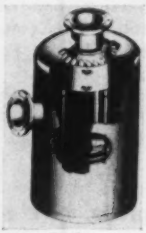
HPAC 15—Model HX heat exchanger, which the manufacturer describes as offering extremely low pressure drop and incorporating a new design in which the gas



side of the unit may be packed with more secondary surface—Acme Industries, Inc., Jackson, Mich. The product is being exhibited at the 7th All-Industry Refrigeration and Air Conditioning Exposition, Navy Pier, Chicago. A complete line is available for capacities up to 200 tons. Smaller and medium models are suitable for "Freon" 12 or 22 service; larger models are standard for "Freon" 12.

Vapor Purifier

HPAC 16—Receiver type purifier for removing entrainment from vapor lines—V. D. Anderson Co., 1935 W. 96th St., Cleveland 2. Unit is guaranteed to deliver 99.9 percent quality steam in steam installations, i.e., to purify steam from a boiler having a concentration of 1000 ppm solids to less than 0.5 ppm solids, and, in exhaust steam, to remove 99 percent of the oil or deliver exhaust steam containing less than 2.5 ppm oil. Entrainment laden vapor enters the receiver at the inlet and drops suddenly in velocity, causing most of the entrainment to drop to the bottom of the drain. The vapor then passes into a purifier inside the drum, which removes most of the remaining entrainment, then discharged by ejects. Units are available in nominal sizes from 4 to 16 in.



Purifier

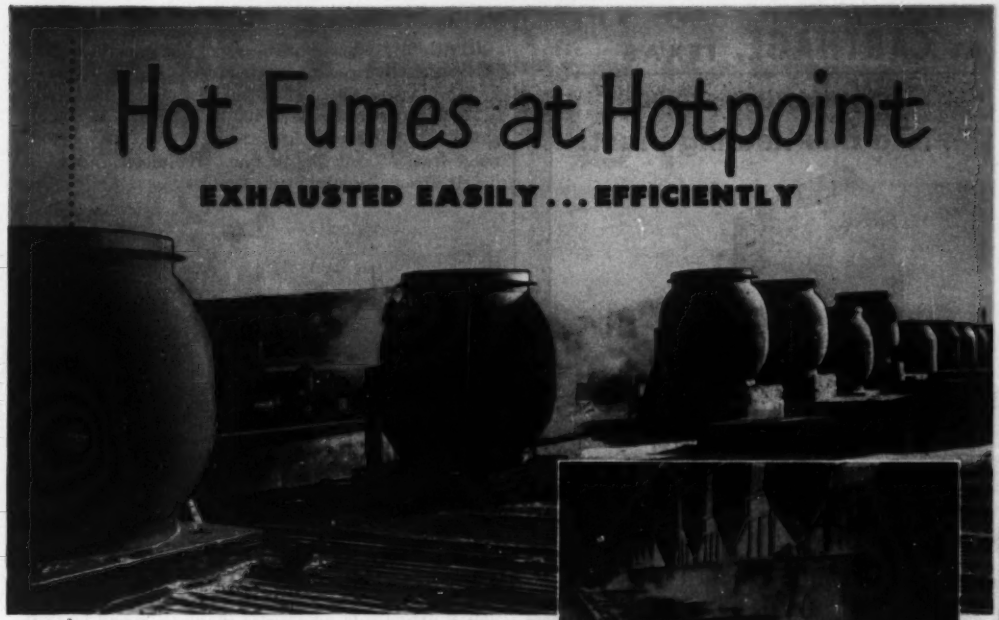
Grinding Wheel

Grinding Wheel and Wire Brush

HPAC 17**—Flexible shaft grinding wheel and wire brush for use in shops doing maintenance and contract work—Barton Products, Inc., Defiance, Ohio. It has a ¼ hp motor, and operates on a 110 volt, single phase, 60 cycle current. The industrial flexible shaft is 6 ft long.

Hot Fumes at Hotpoint

EXHAUSTED EASILY . . . EFFICIENTLY



ABOVE: 10 DeBothezat Bifurcator Fans, with Haveg housing, on the roof of Hotpoint's washing machine plant in Chicago.

RIGHT: Hotpoint washer tubs get a hot sulphuric acid bath in these tanks before porcelain finish is applied.

If corrosive fumes from cleaning and pickling tanks pose a problem for you, take a tip from Hotpoint's experience. Hotpoint uses a ventilation system that pulls hot sulphuric acid fumes and alkali fumes laterally across cleaning tanks away from working areas and up into wooden ducts. In addition to protecting workmen and equipment, this lateral ventilation system also permits clear work space and much better light over the tanks. Fumes are exhausted by 10 DeBothezat Bifurcator Fans, with Haveg housings, which are installed on the roof.

HOW BIFURCATOR FANS WORK

The DeBothezat Bifurcator is a direct motor-driven fan with a divided housing. Motor is mounted in a separate chamber, open to the air but isolated from destructive fumes which are by-passed (bifurcated) around it. Bifurcators can be constructed with housing made of Haveg (a phenol-formaldehyde plastic) as illustrated here, or they can be made of carbon steel, stainless steel, monel metal, with lead or rubber lining and many other materials.

FREE 32-PAGE BULLETIN

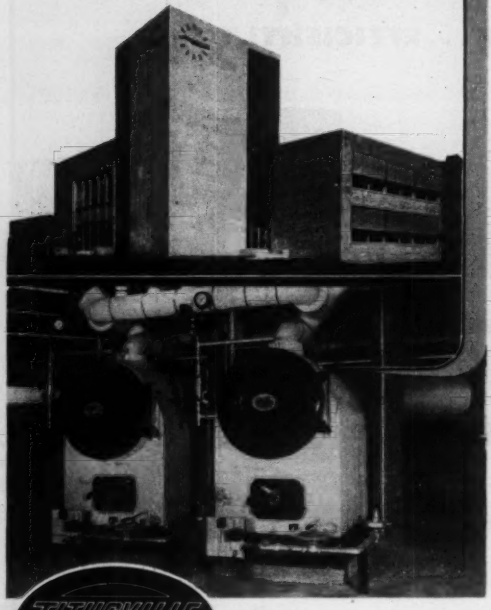
"Design Data for Lateral Tank Ventilation." Contains data for standard 2-sided tank exhaust, rear manifold exhaust and jet "push-pull" systems. Ten charts showing velocity pressures, duct heights in feet and CFM for various types of tanks. Ask your DeBothezat Fans representative for a copy or write our factory, Dept. HP1151.

DEBOTHEZAT FANS DIVISION
American Machine and Metals, Inc.
EAST MOLINE, ILLINOIS

AT CARTHAGE, TEXAS

. . . a fine new school

. . . a fine heating plant!



TITUSVILLE IRON WORKS CO TITUSVILLE, PA

Compact

STEEL

HEATING BOILERS

The heating requirements of the new Carthage Junior and Senior High School are served effectively by these two Titusville Compact Steel Boilers. Rated (normal) at 17,000 square feet of steam radiation per hour—the modern gas-fired units occupy minimum boiler room space. Titusville manufactures a complete line of high and low pressure fire and watertube boilers to meet all capacity and pressure requirements. Our bulletin, "Meet the Titusville Family" sent on request.

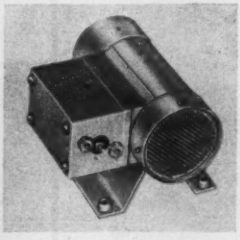
THE TITUSVILLE IRON WORKS CO.

A division of Struthers Wells TITUSVILLE PENNA.

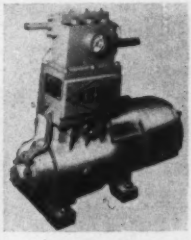
Representatives in Principal Cities

Vaneaxial Blowers

HPAC 18**—Vaneaxial blowers to be applied in glove fit locations for cooling electronic equipment — Stanat Tool & Machine Co., 47-28 37th St., Long Island City 1, N.Y. Units are available in 400 cycle, 3 phase and single phase; 60 cycle single phase; and 27½ volt d-c. Speeds range from 3300 to 10,000 rpm. The motor, located in the air stream, is cooled by the fan blast.



Blower



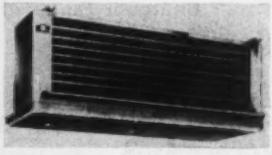
Pump

High Pressure Triplex Pump

HPAC 19**—High pressure triplex pump for use as a heavy duty packaged hydraulic power generator for all types of hydraulic power systems—Kobe Inc., division of Dresser Equipment Co., Huntington Park, Calif. The unit is available in 15, 30, and 50 hp sizes with pressure ratings up to 5000 psi and displacement ratings to 60 gpm. Special 10,000 and 20,000 psi heads are available. The pump is completely enclosed, and plungers and liners are interchangeable, providing a variety of pressure-volume ratings for each unit.

Control for Industrial Process Variables

HPAC 20—"Tel-O-Set" controller for flow, temperature, pressure, liquid level and other industrial process variables — Minneapolis-Honeywell Regulator Co., Wayne & Windrim Aves., Philadelphia 44. Available in two types, one with fixed (illustrated), the other with adjustable proportional band, the instrument operates on a pneumatic balance principle. Units are constructed of a number of coded, interchangeable sections separated by diaphragms.



Left: Controller

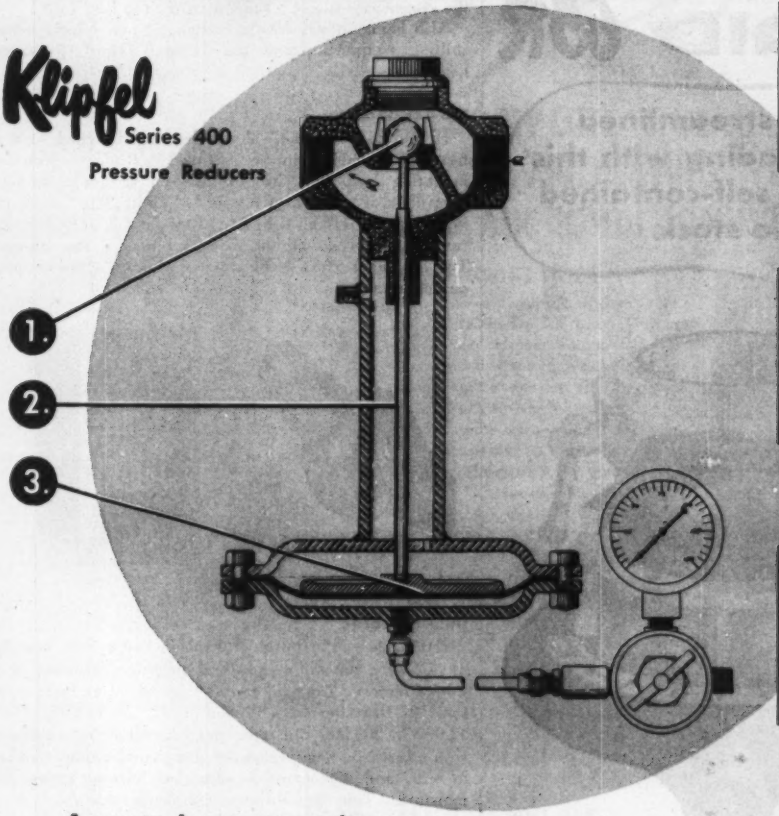
Above: Cooler

Low Temperature Unit Coolers

HPAC 21—Seven models of low temperature unit coolers utilizing ammonia refrigerant, and seven similar "Freon" models — York Corp., York, Pa. The new units are for use in frozen food storage, meat packing and ice cream plants, and in similar applications requiring below freezing temperatures. Water spray provides rapid defrosting, the manufacturer states. The units may be used in combination where greater capacities are required.

only 3 moving parts

Klipfel Series 400 Pressure Reducers



No. 432 with constant air supply—for quick, easy adjustment.

No. 431 with air dome—for isolated installations.

No. 430 with separate air tank—for variable ambient temperature.

Accurate low-cost regulators . . .

FOR longer service with negligible maintenance, operating parts are reduced to just three, inner valve, stem and diaphragm, in the Klipfel 400 Series air-loaded Pressure Reducing Valves. In addition, these 400 Series Valves provide exceptionally close regulation for an unusually low initial cost.

The stainless steel ball inner valve is a perfect sphere, extremely hard and well guided to close to a tight seat. Easily reseated if necessary . . . is self-cleansing and non-sticking. Diaphragm is always in balance . . . no stress, no bursting. Regulation is accurate and easily controlled. For increased safety, flow automatically shuts off in case of diaphragm failure.

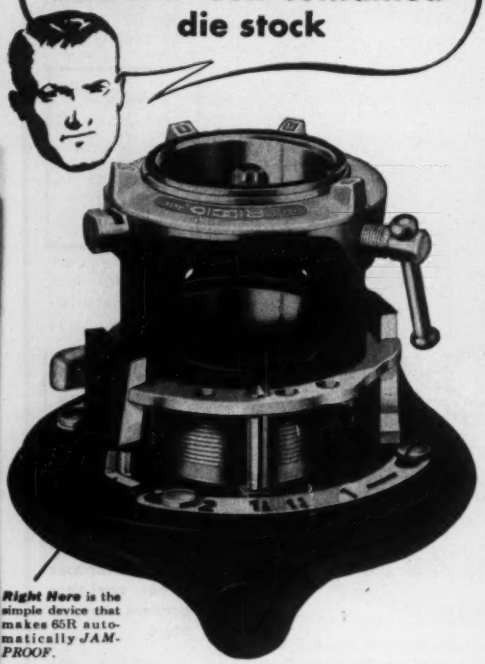
For full data on the Klipfel 400 Series Valves, for steam, air, water or gas, write Dept. F-11 for Bulletin No. 148.

Klipfel VALVES INCORPORATED

DIVISION OF HAMILTON-THOMAS CORP., HAMILTON, OHIO

You can't jam the new RIDGID 65R

Really streamlined pipe threading with this RIDGID self-contained die stock



Right Here **is the simple device that makes 65R automatically *JAM-PROOF*.**

● You don't have to watch it—lead screw can't jam on workholder. New jam-proof drive plate automatically kicks out driving ratchet pawl when standard length thread is cut. Your recent model 65R easily converted—just buy new drive plate, put in place of old plate. Perfect threads on 1" to 2" pipe with one set of 4 high-speed steel dies—sets to pipe size in 10 seconds, mistake-proof self-centering workholder sets instantly! Buy the new jam-proof RIDGID 65R at your Supply House.

RIDGID

★ Work-Saver Pipe Tools ★

Air Conditioning Equipment

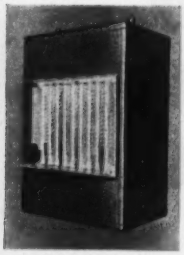
HPAC 22—Multi-package systems in new sizes of 40 and 60 tons—Typhoon Air Conditioning Co., Inc., 794 Union St., Brooklyn 15. Applications of the systems are being illustrated at the 7th All-Industry Refrigeration and Air Conditioning Exposition, Navy Pier, Chicago. The control used enables the operator to put one section of the system into use at a time, according to heat load.

Also being shown are the company's new remote water chilling equipment, and the "Prop-R-Temp" packaged heat pump.

Blower Bearing

HPAC 23—"Univoil" blower bearing designed so that bearing assembly can be revolved 360 deg within its mounting lock ring, keeping the oil reservoir on top, regardless of position of blower — Viking Air Conditioning Corp., 5601 Walworth Ave., Cleveland 2. The bearing can be removed without disassembling of the blower. The bearing surface is of sintered bronze, a thermo-porous material.

Blower Bearing



Duct Furnace

Duct Furnaces

HPAC 24—"Pittsburgh" duct furnaces for installations where the air supply and pressure originate at a source removed from the unit—Automatic Gas Equipment Co., 307 Brushton Ave., Pittsburgh 21. Sizes range from 12,000 to 200,000 Btu input per hr. Units are equipped with a cast iron heat exchanger and a combustion chamber to withstand the corrosive effects of burning gases and moisture. They are shipped completely assembled, with controls and built in draft diverter.

Motor Starters and Motor

HPAC 25—Dustproof centrifugal motor starting switch, a 15 hp, two pole, hermetic motor for commercial size units, and welded starters used on hermetic integral frame motors—Emerson Electric Mfg. Co., 8100 Florissant Ave., St. Louis 21. This new equipment is being exhibited at the 7th All-Industry Refrigeration and Air Conditioning Exposition, Navy Pier, Chicago.

Valve Seal

HPAC 26**—"Rand" cone shaped valve seal, which is closed in the same direction as the movement of the liquid, allowing high or low pressures to seal the valve—Rodic Chemical and Rubber Corp., New Brunswick, N.J. The cup shaped conical washer of the seal incorporates an imbedded metal plug which eliminates bending and warping and makes the seal leakproof, the manufacturer

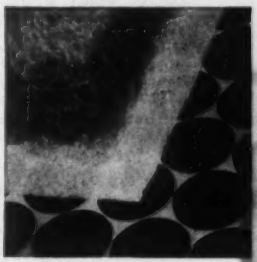
Glasfloss

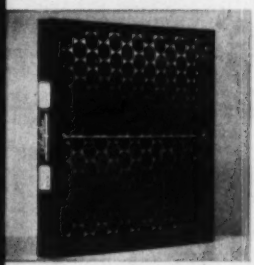
A COMPLETE LINE . . . FOR ALL FORCED AIR HEATING, VENTILATING AND AIR CONDITIONING SYSTEMS

. . . the best, most complete, most profitable line on the market

GLASFLOSS I-S FILTER

For peak air cleaning efficiency, the GLASFLOSS I-S Air Filter Unit is the answer. Here a strainer mat has been added to the famous long, glass fibers that make up the standard GLASFLOSS Air Filter pad. The combination brings air filtering efficiency to as high as 95%. No other air filter on the market can compare.





GLASFLOSS STANDARD FILTER

This is the conventional type — the filter most in demand. The long, fine glass fibers provide a greater surface area to catch and hold more dust with less air resistance. The Glasfloss STANDARD Filter is primarily intended for home heating equipment and normal industrial installations. Available in all standard sizes.

GLASFLOSS ROLL-PAK

Here is a product carefully planned for bulk users. Cut your own filter pads—fit them into your own frames and save, with every change, as much as 30% of your air filter costs. Available in rolls, 40″ wide and 10′ long and in 1″ and 2″ thickness. Application is easy. Just roll it out, cut to size and put into position. The fluffy, fine fibers are easy on the hands.

For Complete details on any product in the GLASFLOSS Line, write Dept. HP-11

Glasfloss

155 EAST 44th STREET, NEW YORK 17, N. Y.

WEBSTER KINETIC* BURNER

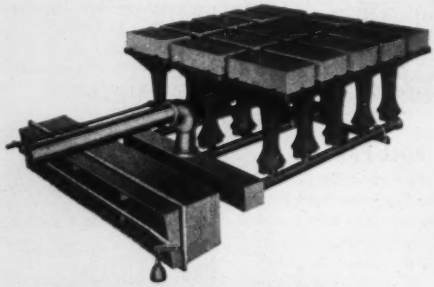
For Low Pressure Gas

The Webster Kinetic consists of a multiplicity of full venturi mixers with flame retention nozzles. These are assembled in a metal casing complete with pilot and louvre. It may be used with natural, mixed or liquefied petroleum gases. Standby oil burners may be used when desired. As a multiple head assembly it is available in 25 standard sizes of from 4 heads to 48 heads, and can be supplied in any size or shape. Natural gas input ratings from 560,000 Btu/hr to 6,720,000 Btu/hr at 4" wc.

For complete information request Series B8 Bulletins.

WEBSTER SERIES F 600 BURNER

For Low Pressure Gas

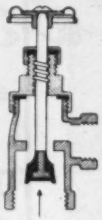


Designed for LOW GAS PRESSURE
INTERCHANGEABLE PORTS
RADIANT fire brick top
NO COMBUSTION CHAMBER required
Will NOT VIBRATE
LOW draft loss
ANY SHAPE and SIZE
INTEGRALLY MOUNTED pilots

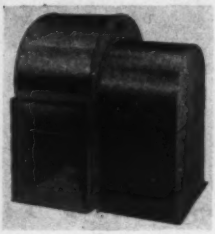
*TRADEMARK

The WEBSTER ENGINEERING COMPANY
TULSA, OKLAHOMA
Division of SURFACE COMBUSTION CORPORATION, Toledo, Ohio

states. If contaminants in the fluid, such as sand or grit, are not pushed ahead of one sealing line contact, the conical shape of the seal provides establishment of a new line contact without damage to the bore. The rubber member of the seal is compounded to withstand oil, grease, steam, water, and most industrial chemicals.



Seal



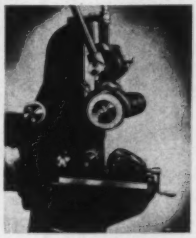
Fan

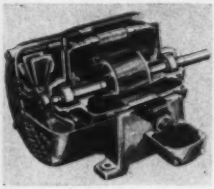
Centrifugal Fan Arrangement

HPAC 27—Centrifugal fan arrangement No. 10 (weatherproof hood over motor drive section) which can be installed outdoors without further protective enclosure —The Trane Co., La Crosse. It is available with wheel diameters up to 60 in., in backwardly inclined and forwardly curved, single width, single inlet models in Class I construction.

De-Scaler, Cleaning Attachment

HPAC 28—Pipe and tube de-scaling and cleaning attachment, to be used with "Steen" cutoff machines, for cleaning off rust, scale, paint and other deposits—Continental Machine Co., 1952 N. Maud Ave., Chicago 14. Sizes are available for cleaning pipes up to 12 in. in diameter. Most work requires only one pass through the rollers, and the attachment feeds up to 20 fpm of pipe, the manufacturer states.





Left: De-Scaler
Above: Motor

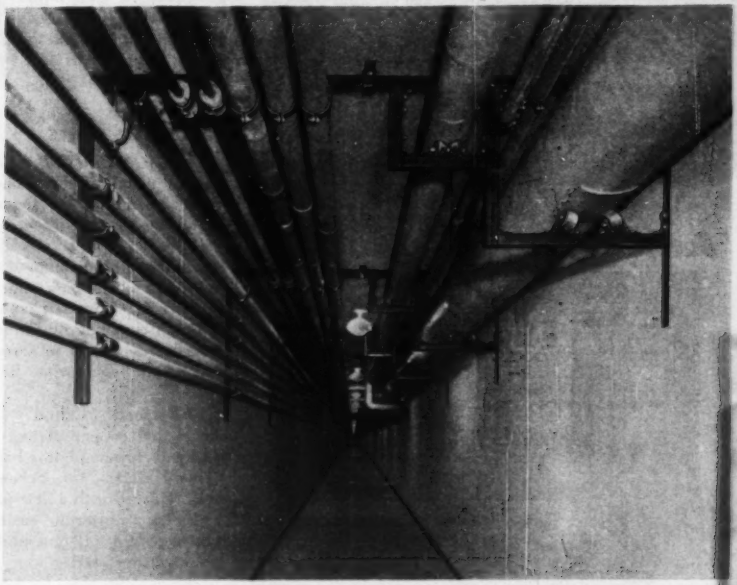
Explosionproof Motor

HPAC 29—Totally enclosed motor for explosionproof requirements (types SE and SES) — U.S. Electrical Motors, Inc., 200 E. Slauson Ave., Los Angeles 54. Available in capacities of from 3 to 75 hp, it carries the Underwriters' label in class I, group D, for highly inflammable gases and volatile liquids, and in class II, groups F and G, for combustible dusts.

Self Priming Motor Pumps

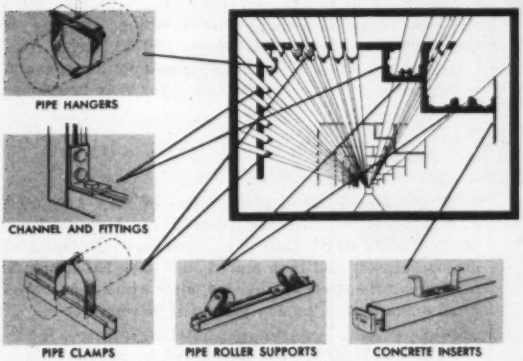
HPAC 30—Motor pumps which maintain prime in suction lift applications by means of recirculating liquid trapped in the casing — Ingersoll-Rand Co., Dept. CAM, 11 Broadway, New York 4. The impeller discharges through two passages into a chamber. During priming, the

UNISTRUT® METAL FRAMING SYSTEM DOES THE ENTIRE JOB* FOR PUBLIC SERVICE COMPANY OF INDIANA, INC.



* Tunnel for all services—electric, steam, water, air and oil lines.

Specifications: Nasss & Murphy, Architects—Engineers.
Contractor: Gust K. Newberg Construction Company
Electrical Contractor: Hatfield Electric
Process Piping: Hayes Bros., Inc.



In this large main tunnel installation at Plainfield, Indiana, UNISTRUT channel, concrete inserts, pipe rollers, hangers and clamps support electric, steam, water, air and oil lines—all the services in *one neat package!*

This completely adjustable metal framing system provides a new and more flexible type of mechanical support for every kind of piping, conduit and cable. Assures exact slope or pitch. Permits adjustments, changes or additions to be made at any time. No drilling, no welding, no special tools or equipment. The UNISTRUT method conserves steel, reduces manpower hours, cuts over-all costs.

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☐ New Catalog No. 700 ☐ UNISTRUT Sample
☐ Wall Chart
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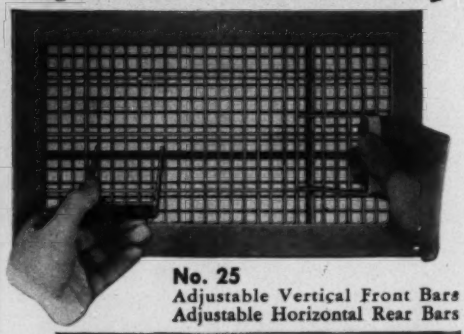
INDEPENDENT

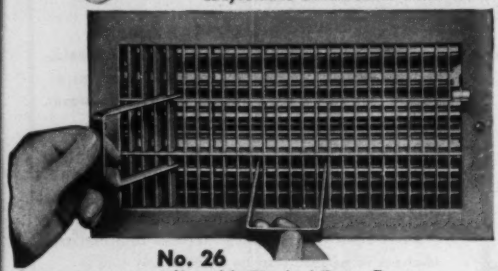
"Fabrikated"

DOUBLE CORE ADJUSTABLE BAR WALL GRILLES AND MULTIPLE VALVE REGISTERS

Each Grille Bar Adjusted Individually



No. 25
Adjustable Vertical Front Bars
Adjustable Horizontal Rear Bars



No. 26
Adjustable Vertical Front Bars
Adjustable Horizontal Rear Bars—with Horizontal Multiple Valves.

Depth with valves closed 1⅛"
Depth with valves open 2¼"

MEMBER NATIONAL WARM AIR HEATING AND AIR CONDITIONING ASSOCIATION
INDOOR COMFORT

Always Leading • Always Progressing

THE INDEPENDENT REGISTER CO.
3747 E. 93rd STREET • CLEVELAND, OHIO

upper passage discharges a mixture of vapor and liquid into the chamber. Vapor separates from the liquid and passes out the discharge pipe. The remaining liquid re-enters the impeller through the lower passage to mix with more vapor drawn in from the suction pipe and separated from the liquid in the same manner. When the suction pipe is filled with liquid, and the pump is primed, flow through the lower passage reverses and both passages act as normal pump discharges. Built in sizes from ¼ to 25 hp, the pump is said by the manufacturer to have capacities up to 800 gpm and a head up to 180 ft.

EQUIPMENT BRIEFS

CUSHION CLUTCH AIR SCREW DRIVER for fabrication of metal products and other applications involving screw assemblies — Ingersoll-Rand Co., Dept. PT, 11 Broadway, New York 4. It is available in three basic sizes — for small screws up to No. 8 free running or No. 5 self tapping; medium screws up to ¼ in. free running or No. 10 self tapping; and large screws up to 5/16 in. free running or ¼ in. self tapping. Construction features include an engaging clutch, enabling the screw driver to be moved from screw to screw without stopping the motor, and a ball type torque limiting clutch.

Redesigned "Calrod" *IMMERSION HEATERS* for nickel and copper plating baths and for mild sulphuric acid and chrome plating baths — Industrial Heating Dept., General Electric Co., Schenectady 5. The sealing cup has been replaced with a new junction box of terminal housing which is vaportight, easier to repair in the field, and which reduces the possibility of faulty connections, the manufacturer states.

"Rust-Cure" *ANTI-RUST PAINT*, which can be applied over rust without previous wire brushing, scraping or sandblasting — The Monroe Co., Inc., 10703 Quebec Ave., Cleveland 6. Available in black, aluminum and clear, it is compounded for brush application, but may be thinned for spraying.

WE HEAR THAT . . .

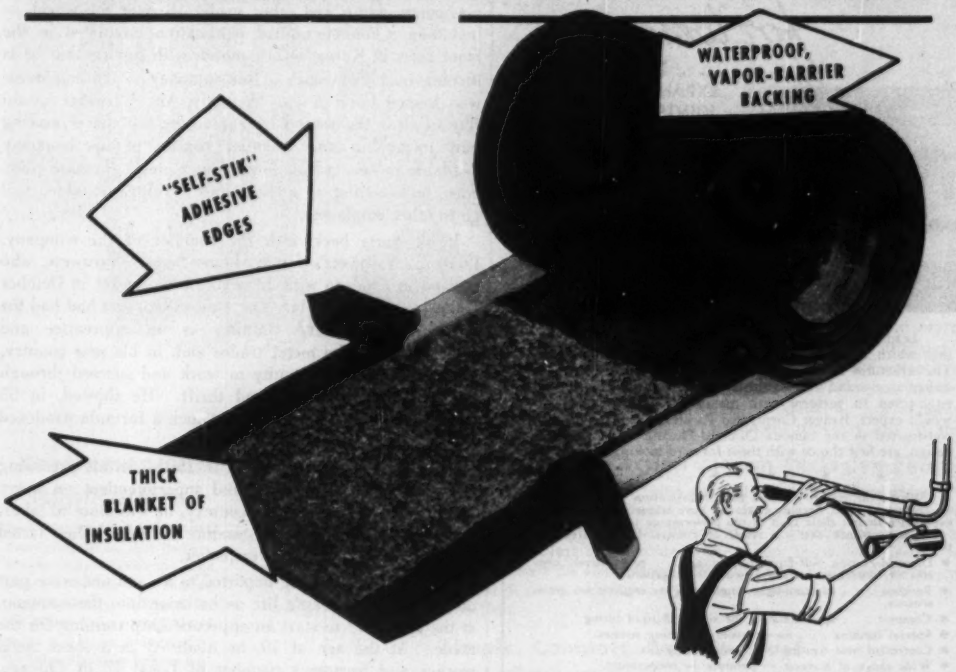
All the executive and plant offices of *THE LINCOLN ELECTRIC CO.* have been moved to the new headquarters at 22801 St. Clair Ave., Cleveland. The machine division already had been moved, and work has begun on moving out the electrode division, after which the transfer of all operations to the new plant will be complete.

GRANT WILSON, INC., has moved its executive offices to larger quarters in Suite 1560, Board of Trade Bldg., 141 W. Jackson Blvd., Chicago.

THE TRANE CO., La Crosse, has declared a stock dividend of 300,000 common shares, effecting a two-for-one split of the outstanding shares of the company's common stock traded on the Midwest Stock Exchange. The dividend was declared payable as of December 20 to the stockholders of record November 30. The directors also authorized transfer of $600,000, the aggregate par value of the shares to be issued as a dividend, from paid-in surplus to the capital stock account.

MYSTIK DRI-PIPE INSULATION

Holds Cold and Heat • Prevents Condensation



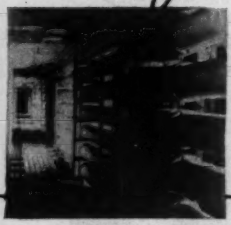
MYSTIK DRI-PIPE—the insulation with "self-stik" edges—goes on fast, saves time and money on installation. Ideal for low-temperature applications—on cold water lines, cold air ducts, refrigeration lines. Holds temperatures, prevents condensation and dripping, eliminates icing and frosting on refrigeration lines. Also has extensive other cost-cutting insulation uses—on warm water lines, warm air ducts and for sound deadening. Ask your supplier or . . .

WRITE NOW for free sample of MYSTIK Self-Stik DRI-PIPE Insulation
to Mystik Adhesive Products, 2653 N. Kildare, Chicago 39, Ill.

MYSTIK CLOTH TAPES • MYSTIK PAPER MASKING TAPES • MYSTIK SPRA-MASK • MYSTIK PROTECTO-MASK • MYSTIK SAND-BLAST

ENGINEERED
for tomorrow

. . . Badger EXPANSION JOINTS . . . assure long, trouble-free life . . . an engineering masterpiece



Leading textile plants are erecting ultra-modern buildings which are both *designed* and *engineered* for tomorrow. The structures represent the very latest trends in functional design . . . and the steam distribution systems must be engineered to perform with maximum efficiency. As you would expect, Badger Corrugated Packless Expansion Joints, constructed to the famous Directed-Flexing Self-Equalizing design, are first choice with these forward-looking companies.

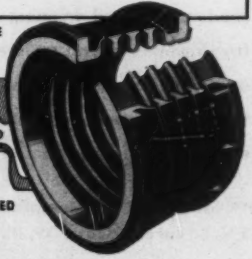
* * * * * *

What's the reason you find Badger Expansion Joints specified on *important* jobs? Because engineers have learned from years of experience to put their faith in the performance of Badger Joints . . . performance that's a result of construction features like these:

- Directed-Flexing Self-Equalizing rings . . . progressively control the movement of the all-curve corrugations.
- Packless . . . pressure-tight single tube — requires no maintenance.
- Compact . . . approximately the size of flanged fitting.
- Special forming . . . no structure-weakening stresses.
- Controlled heat treating . . . assures long life.
- Wide range of traverse — pressure — temperature.

Fabricated from deoxidized copper for normal pressures and temperatures, stainless steel or alloys to withstand high pressure, temperature and corrosion.

WRITE TODAY FOR FREE 24-PAGE CATALOG SHOWING COMPLETE LINE



Badger
MANUFACTURING COMPANY
230 BENT STREET, CAMBRIDGE, MASS.

DRAVO CORP., Pittsburgh, has opened a new shop with fabricating and welding facilities for servicing and maintaining air conditioning and combustion systems throughout western Pennsylvania. The shop, occupying 19,500 sq ft of floor area, is at 3901 Second Ave., Oakland. The addition also will provide manufacturing space for some of the company's products.

The Peoria office of *BELING ENGINEERING CONSULTANTS*, Moline, is now located at Suite 302, Medical Arts Bldg., 1101 Main St. . . . . The general sales offices of *THE SEAMLESS RUBBER CO.*, New Haven, are now located at 464 Congress Ave.

Narowetz Plan Aimed to Promote Private Enterprise

Louis L. Narowetz, president of the Narowetz Heating & Ventilating Co., Chicago, hit the newspapers, news magazines, radio and other media all over the world — including a mimeographed publication circulated in the front lines in Korea — last month with reports that he is turning over ownership of his company to the employees who helped build it up. Actually, Mr. Narowetz would like to clear the record by explaining that he is making part ownership and eventual control of his company available to selected employees on a stock purchase plan. Also, he is setting up a trust fund, earnings on which will go to other employees.

It all starts back with the founder of the company, Louis L. Narowetz's father, Louis Semon Narowetz, who arrived in Chicago with 13 cents in his pocket in October 1886, from old Bavaria. The senior Narowetz had had the thorough old-country training as an apprentice and journeyman in the metal trades and, in his new country, asked only the opportunity to work and succeed through his own energy, ability and thrift. He showed, in 55 years of active business life, that such a formula produced results.

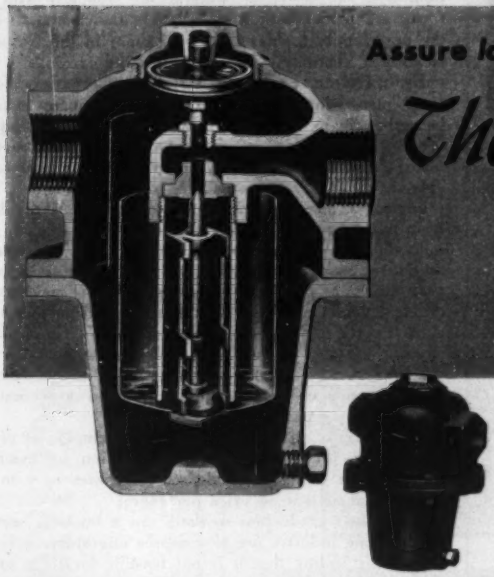
He started his own business in 1901. In his preceding 15 years as a journeyman and superintendent on many famous jobs throughout the country, he was close to labor, and friendships and understanding developed then lasted throughout his life as an employer.

These principles were imparted to his son and were part of Louis L. Narowetz's life as he came into the company at the age of 17 to start an apprenticeship training for the trade. At the age of 19, he qualified as a sheet metal worker and became a member of Local 73 of Chicago, which his father helped to organize. He went on to head the company which has numbered among its customers many famous large buildings and industrial plants in every part of the United States, totalling millions of dollars worth of work.

It has always been Louis L. Narowetz's belief that good labor relations are a primary essential to a successful business, that even though an industry operates within an agreement with any union, it is possible to develop relations between management and labor to include profit sharing and that labor should not be considered a commodity, but an important part of private enterprise.

His activities have borne out this belief. He has been a leader in encouraging the system of collective bargaining along a pattern sponsored by the International Union

ILLINOIS
Float & Thermostatic TRAPS



Assure lower return line temperatures

They're different!

–in construction

–in performance

ILLINOIS Float & Thermostatic Traps operate under vacuum with the same high efficiency as under pressure. No more water-logging of mains . . . no more air binding . . . end "morning overload" troubles. The instantaneous action of the condensate valve assures complete drainage of condensate. A separate thermostatically controlled valve vents air continuously in large volume, yet positively prevents loss of steam.

Recommended Applications

Low Pressure Heating Systems, Ventilating Units, Unit Heaters, Pre-Heaters, Re-Heaters, and other Fan System Heat Surface, Large Radiators or Pipe Coils, Hot Water Generators, Drips of Mains and Risers. Draining Coffee Urns, Warming Tables, Pasteurizers, Vacuum Pans, Heat Exchangers, Process Heaters, Sterilizers, Autoclaves, Cooking Kettles, Kilns and similar equipment.

(For operating ranges from 25 inches vacuum to 15 pounds pressure use Series G Traps. For pressures up to 50 pounds use Series MG.)

Rated capacities of various size traps from 200 pounds to 5000 pounds condensate per hour, at 2 pounds differential across the trap.

Positive, Instantaneous Valve Action . . . an Exclusive Feature

The Snap Action of the Condensate Control Valve assures efficient trap operation. The valve is not directly attached to float but is actuated by impact of the dropping float. Valve action is instantaneous whether the trap is handling its maximum capacity or only a trickle of condensate and regardless of variation in pressures. The valve is either wide open or tight shut—never cracked on seat, never hanging in an intermediate position. It is water-sealed at all times. It cannot chatter and is never affected by pulsations in the flow of condensate to the trap.

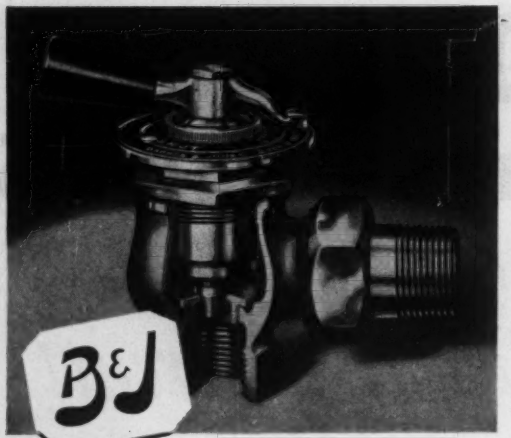
Simple, Compact, Trouble-proof

No ball floats to puncture or collapse—no toggles, pins, levers or hinges to corrode, stick or bend. Hard, stainless alloy steel renewable valves and seats are used for both condensate and air bypass units. Both valve units are at the top of trap out of dirt and sludge, assuring long life and satisfactory operation without attention. Straight through connections save head room, fittings, trenching, labor, and avoid low hung piping or lifts. Trap is easily opened for inspection without disturbing piping.

TRAP NOT DAMAGED BY FREEZING. Freezing will not harm this trap in any way and it is self-thawing.

Write for Bulletin 34-C

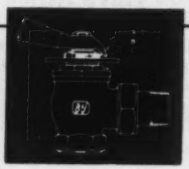
ILLINOIS ENGINEERING COMPANY
INCORPORATED 1900
RACINE AVENUE AT 21ST STREET • CHICAGO 8



ORIFICE VALVE Type H Simplifies Setting, Readjusting, Reading

This Barnes & Jones Valve is designed for easy adjustment to different capacities after installation and to provide a ready indication as to the *correctness* of the adjustment. When changing adjustment, no piping nor machine parts need be disconnected, and the steam system need not be shut off. Dial indicates in square feet of radiation the capacity for which the valve is adjusted.

Note Simplicity of Method of Changing Adjustment



1. Loosen lock nut (B) with pliers and reset inner dial to desired point and tighten lock nut. Loosen lock nut (C) with special B&J wrench, which we supply for this valve.
2. Turn indicator (A) in clockwise direction until valve seats.
3. Turn dial assembly so that "shut" registers with pointer of indicator. Then tighten lock nut (C).

B&J

BARNES & JONES, Inc.

128 BROOKSIDE AVENUE, BOSTON 30, MASS.

Representatives in all principal cities

and the National Association of Sheet Metal Contractors. He has initiated a welfare plan for the sheet metal industry and helped establish such a plan for sheet metal workers in the Chicago vicinity. He has served on the national joint board for settlement of jurisdictional disputes as the sheet metal industry's sole representative. He is currently a member of the liaison committee of mechanical trades appointed to look after the industry's interests in connection with commercial as well as defense work.

And now, at the end of 40 years of this kind of association, it is his desire to continue the company with the forthright principles initiated by his father and to give the opportunity to his workers to share in the Narowetz Heating & Ventilating Co.'s activities and earnings.

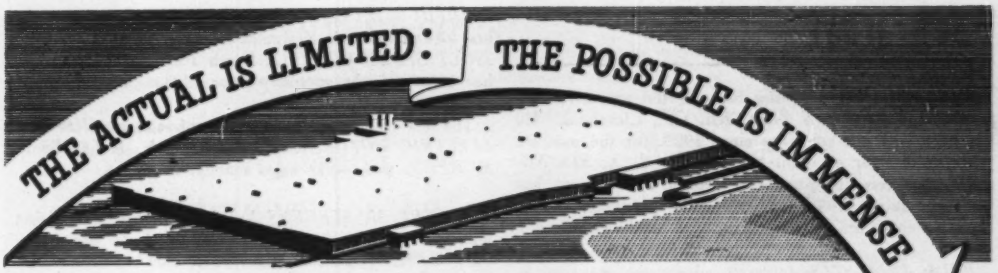
He, therefore, established last December a stock purchase plan, whereby 48 percent of the company stock is being bought by a group of key employees who comprise the company's board of governors. This plan contemplates complete payment by the various individuals involved for their respective shares of the stock over a five-year period, and the shares are issued to the individuals from time to time as payment for them is completed. The individual receives immediately the quarterly dividends on all the shares he is buying, and thus he has these funds (as well as any other resources the individual may wish to devote) to use in paying for his stock. All payments are made by the individuals to the company's bank, which issues the stock to the individuals as payment for the various shares is completed. Since the individual receives full dividends upon subscription, he pays 4 percent interest on his unpaid balance.

Ownership of the stock is confined to employees of the company, so that in the event of resignation, for example, the owner of the stock would sell his shares back to the company at an agreed price per share.

Since the "production workers" in a business serving the building industry are to a degree migratory, it is Mr. Narowetz's feeling that it is not feasible for them to become direct owners of stock. However, in order that they too may participate in some of the advantages of employee ownership of the company, Mr. Narowetz plans at an opportune time to set aside 25 percent of the total stock to be held in trust by the bank. The earnings from this block of stock will go to the production employees as dividends are declared, but the production employees do not purchase this stock.

Mr. Narowetz continues to hold the remaining 27 percent of the company's stock. However, the board of governors has been established for eventual control and policy-making of the company, and it is planned that eventually this block of stock will also be available for purchase by the individuals comprising the board of governors. Since management of a firm must see to the finances, procure the work to be done, direct the firm's operations, maintain its credit, etc. it is essential that management — as represented by the board of governors — have the controlling interest, Mr. Narowetz points out.

Mr. Narowetz does not contemplate complete retirement from the Narowetz Heating & Ventilating Co. When control has passed to the board of governors in accordance with the stock purchase plan he has established, he looks forward to serving perhaps as an "elder statesman" and to devoting his efforts where they may be most helpful to his 200 "sons" and the sheet metal industry in particular.



NEW LINCOLN PLANT CREATED BY INCENTIVE-INSPIRED CO-ACTION IN DEVELOPING POSSIBILITIES IN PRODUCT

© LE Co. 1951

UNIQUE SUPPORTS SOLVE PIPING PROBLEMS

UNUSUAL use of welded steel supports has greatly simplified and speeded the installation of steam lines at the Ford Motor Company's recently completed power plant in Cleveland, Ohio. Components for the supports shown were flame cut from steel plate and completely shop fabricated. Assemblies then were welded to the pipe on the job with Lincoln "Fleetweld" electrodes, using Lincoln "Shield-Arc" engine driven welders.

Fig. 4—Pipe Cradle Support *shop fabricated from ¼" steel plate is used where pipes pass over girders. Note cross support "I" beam fillet welded to girder.*

Fig. 3—Support for Risers *is fabricated from ¼" plate and fillet welded to pipe and to overhead "I" beam. Hanger shown at right is for initial installation of pipe only before risers are added.*

HOW TO CUT INSTALLATION COSTS

Fig. 1—Simplifies Insulation *by adding spacer between 12" pipe and hanger. Spacer is bent from plate and welded directly to steam line.*

Fig. 2—Overcomes Space Restriction *by use of short pipe turns welded to steam line with three passes of Lincoln "Fleetweld" 5 electrode.*

SAVES STEEL, SAVES MAN-HOURS ON POWER PLANT JOB

Lincoln bulletin "Welding Guide" free on request. Write to Dept. 283,

THE LINCOLN ELECTRIC COMPANY

CLEVELAND 17, OHIO

WHO'S WHAT

WILLIAM IRRGANG has been elected executive vice president of *LINCOLN ELECTRIC CO.*, Cleveland. He has been with the company since 1929, for the past six years as director of plant engineering. *L. K. STRINGHAM*, most recently director of welding development, has been appointed chief engineer for the company. *G. G. LANDIS* continues as engineering vice president.

PAUL W. AUSTIN, formerly advertising manager, is the newly elected secretary and assistant treasurer of *UNION ASBESTOS & RUBBER CO.*, Chicago. He replaces *A. ARTHUR HALLE, JR.*, who has resigned. The advertising and public relations department has been dissolved, and Mr. Austin will direct public relations, in addition to carrying out his new duties. *WILLIAM HART ADLER* will handle the company's advertising.

A. J. HALL, formerly director of personnel, has been made assistant vice president in charge of personnel and industrial relations for all divisions of the *BURNHAM CORP.*, Irvington, N.Y.

SYNCROMATIC CORP., Watertown, Wis., has announced that *A. B. ALGREN*, professor of mechanical engineering in charge of warm air heating and air conditioning research at the University of Minnesota, has become research and engineering consultant to the chief engineer and company treasurer, *JOHN F. HIRTZ*.

ARTHUR H. SY, most recently sales manager, is the new vice president in charge of sales for *AMERICAN DISTRICT STEAM CO., INC.*, North Tonawanda, N.Y. He has been with the company since 1923.

The new vice president in charge of sales for *HOWELL ELECTRIC MOTORS CO.*, Howell, Mich., is *JAMES F. MURPHY*, previously sales manager.

ROBERT M. STEVENS has been named advertising manager of *SERVEL, INC.*, Evansville, Ind. Since January, he has been sales manager of the company's New York distributing subsidiary.

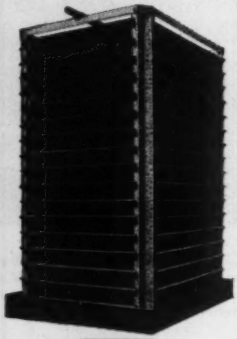
The new sales manager of *INDEPENDENT REGISTER CO.*, Cleveland, is *KARSTEN B. SOLBERG*, who has been with the company since 1935.

H. V. RASMUSSEN, who has spent a number of years with both the Westinghouse Electric Corp., and the De-Laval Steam Turbine Co., has been appointed executive engineer at the Wellsville, N.Y., plant of *WORTHINGTON PUMP AND MACHINERY CORP.*, Harrison, N.J. *CHARLES EBEM WILSON*, formerly sales vice president of the company, has been appointed a west coast consultant on sales problems. In addition, *J. B. LARAMY* is the new manager of the marketing research department. He has been assistant manager of the Chicago district office.

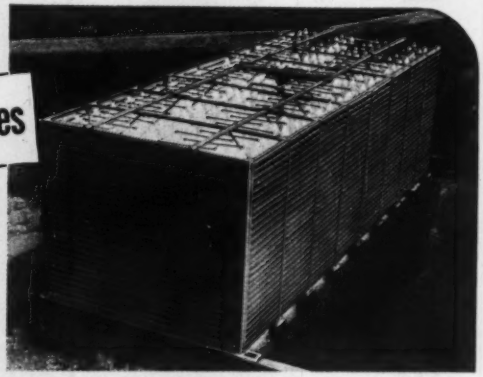
The corporation also has named seven plant executives to new posts. They are *GEORGE P. PASSMORE*, now

Binks NATURAL DRAFT COOLING TOWERS

30 standard sizes



Binks Type "S" Cooling Towers are manufactured in capacity ranges from 10 to 1200 GPM. This wide range of sizes enables you to choose exactly the tower you need to fit your requirements without the needless expense of a custom-built unit. Binks Type "S" Towers are the accepted standard for cooling condenser circulating water from refrigeration and air conditioning compressors, and for cooling water-jacketed engines. They will provide low cost cooling of highest efficiency for any manufacturing process where heat is dissipated by circulating water or other fluids.



Send today

for bulletins describing the Binks Type "S" natural draft cooling towers in which you are interested.

BULLETIN NUMBERS:

30. Single Section Towers
31. Multiple Section Towers (one bay wide)
32. Large Capacity Towers
40. All Redwood Towers

Please state how tower will be used, also capacity required.

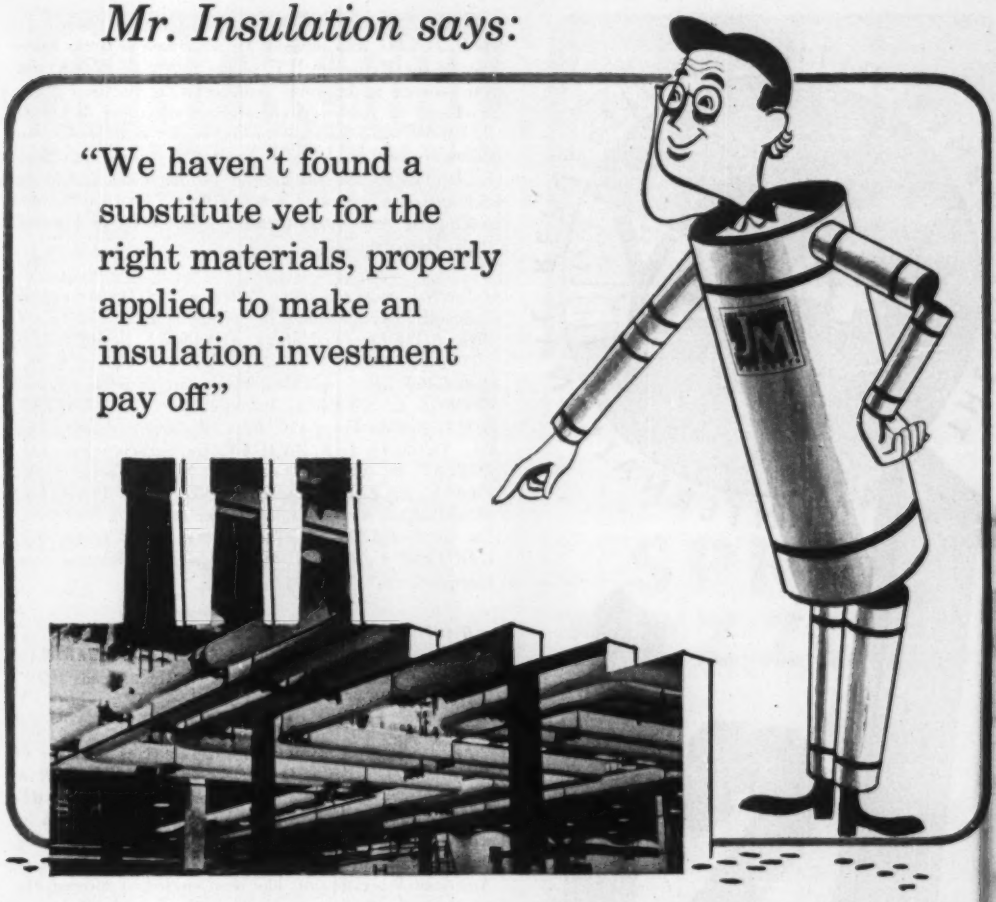
THERE'S A BINKS TOWER FOR EVERY COOLING JOB

Binks MANUFACTURING COMPANY

REPRESENTATIVES IN ALL PRINCIPAL CITIES ■ 3118-38 CARROLL AVENUE, CHICAGO, ILL.

Mr. Insulation says:

"We haven't found a substitute yet for the right materials, properly applied, to make an insulation investment pay off"



To be successful an insulation job must be properly engineered. In addition, it must have these two important ingredients:

1... THE RIGHT MATERIALS: service conditions vary greatly in industrial applications. That's why no one insulation can serve as a jack-of-all-trades on all jobs. For this reason, Johns-Manville uses asbestos and many other selected raw materials to produce the most complete line of insulations available. These insulations serve applications ranging between the extreme temperatures of 400F below zero to 3000F above.

2... THE RIGHT APPLICATION: Here again Johns-Manville's long experience in the field of insulation can be of value to you. Insulation engineering advice plus the services of insulation contractors trained in Johns-Manville methods of correct application are at your call.

If you are planning an insulation job why not put your problem up to insulation headquarters? Write Johns-Manville, Box 290, New York 16, N. Y.

JM

Johns-Manville *first in* **INSULATIONS**

* U. S. DEPARTMENT OF COMMERCE FIGURES

RAY OIL BURNER CO.

SINCE 1872

1301 SAN JOSE AVE., SAN FRANCISCO 12, CALIFORNIA
Atlantic Seaboard Division • 629 Grove Street, Jersey City, N. J.

assistant to the vice president in charge of manufacturing; *A. M. TULLO*, who succeeds Mr. Passmore as works manager of the Wellsville, N.Y. plant; *JOHN BURLICK*, the new assistant to the works manager at the Harrison plant, in charge of industrial engineering activities; *MAX A. HEYMAN*, now assistant to the works manager at the Harrison plant, in charge of production control activities; *W. D. SIZER*, now manager of the regional engineering and service department; and *GEORGE F. HABACH*, succeeding Mr. Sizer in his former post of executive engineer at the Harrison plant.

The National Production Authority, U.S. Department of Commerce, has announced the membership list of the *FAN AND BLOWER INDUSTRY ADVISORY COMMITTEE* as follows: *RAWSON VAILE*, American Blower Corp., *WALLACE W. ALLEN*, American Coolair Corp., *GEORGE E. SZEKELY*, Bayley Blower Co., *WALTER HOLT*, Buffalo Forge Co., *R. A. WASSON*, Clarage Fan Co., *THOMAS J. FLANAGAN*, Garden City Fan Co., *ROBERT W. NELSON*, Herman Nelson Corp., *J. M. FRANK*, Ilg Electric Ventilating Co., *T. I. BYRD*, Lau Blower Corp., *R. D. STUMP*, Meier Electric & Machinery Co., *D. L. HERNDON*, The Murray Co. of Texas, Inc., *GARDNER C. DERRY*, Sturtevant Div., Westinghouse Electric Corp.

HARRY J. NOLES, formerly assistant manager, has been named manager of the air filter division, *AMERICAN AIR FILTER CO., INC.*, Louisville. He succeeds *HOWARD W. POUND*, who died October 10.

FREDERICK W. SMITH has resigned as manager of *BAKER MFG. DIV., AMERICAN WHEELABRATOR & EQUIPMENT CORP.*, and as president of *BAKER REFRIGERATION CORP.*, South Windham, Me., which he will continue to serve as consultant and as a member of the board of directors. *OTTO A. PFAFF*, president of American Wheelabrator, has been elected to succeed Mr. Smith in the Baker presidency. Other executive changes in the corporation include *CHARLES N. BELLM*, elected executive vice president; *MARK MOONEY*, elected a vice president and manager of sales; and *CHARLES MARSHALL*, vice president and contract production manager.

THE INSTRUMENT SOCIETY OF AMERICA, at its sixth annual instrument conference and exhibit, elected the following national officers: *DR. ARNOLD O. BECKMAN*, president; *DAVID M. BOYD, JR.*, vice president; *ROBERT T. SHEEN*, vice president. Still incumbent are: *W. A. WILDHACK*, first vice president; *N. L. ISENHOUR*, vice president; *G. R. FEELEY*, treasurer; and *RICHARD RIMBACH*, secretary.

ALLEGHENY LUDLUM STEEL CORP., Pittsburgh, has announced the appointments of *JOHN E. GROVES* as director of industrial relations and *RALPH L. OSTRANDER* as manager of labor relations.

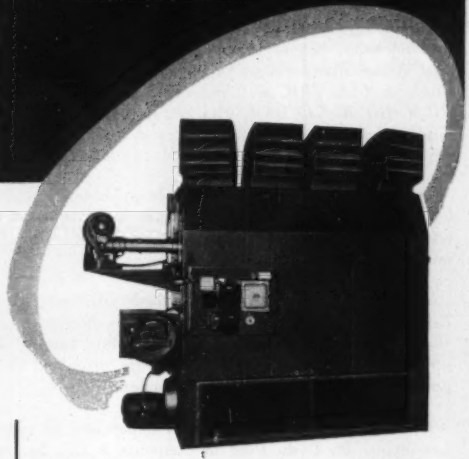
D. PAUL BAILEY, formerly a member of the market research department at *IRON FIREMAN MFG. CO.*, Cleveland, is now director of market research. *ARTHUR*

AIRTHERM

DIRECT FIRED HEATERS

Heat or Ventilate

Installation Requires Less Steel Than Other Type Heating Systems ... Insure Customer Satisfaction



The Airtherm Space Heater has been designed with extreme flexibility for heating as well as ventilating steel plants, foundries, all types of industrial buildings and warehouses. They are quick, easy, and less costly to install and require less duct work and scarce materials. They are furnished complete with all operating and safety controls for automatic operation. Airtherm Space Heaters have a heavy duty steel combustion chamber lined with castable refractory for simple maintenance and long life.

AVAILABLE IN 9 MODELS — Oil* or gas fired — ranging from 650,000 to 2,000,000 B.T.U. per hour output, in floor mounted or suspended types. Write for Bulletin **802A** for complete information.

SEE OUR CATALOG IN SWEET'S

AIRTHERM MANUFACTURING CO.
711 South Spring Avenue
St. Louis 10, Missouri

*Approved by Underwriters' Laboratories

For Complete Customer Satisfaction ...
Think First of **AIRTHERM**

for • SPRAYING
• WASHING
• RINSING
• COOLING
• AIR CONDITIONING

YARWAY

SPRAY NOZZLES

FAN-TYPE FOR FLAT SLICING SPRAY

Get the most out of your Spraying Equipment with minimum power ... with efficient spraying.

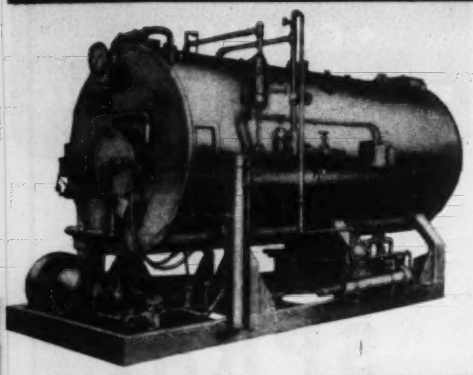
Use Yarway Nozzles. No internal vanes or other restrictions to clog or hinder flow. Two types—Yarway Involute-type producing a fine hollow spray with minimum energy loss, and Yarway Fan-type producing a flat fan-shaped spray with time-saving slicing action for cleaning.

Wide range of standard sizes and capacities. Cast or machined from solid bar stock.

Thousands in use. Write for new Bulletin N-616.

YARNALL-WARING COMPANY
107 Mermaid Avenue Philadelphia 18, Pa.

MODERNIZE
with the
AMESTEAM
GENERATOR



• COMPLETE • COMPACT
• ACCESSIBLE • EFFICIENT
• AUTOMATIC
10 to 500 h. p.—
15 to 200 lbs.

Here are the facts!

WRITE FOR
YOUR COPY

AMES IRON WORKS
BOX 2011 OSWEGO, N. Y.
Builders of Better Boilers since 1848
Manufactured under
License in Canada by VOLCANO, Ltd., Montreal, P. Q.

TRAUB has been appointed to the field organization, and is working on special assignments from the company's headquarters.

ANTHONY G. RUEDIGER is the new director of procurement for *CARRIER CORP.*, Syracuse, succeeding *RALPH H. ANDERSON*, who was granted a leave of absence to work for the Defense Production Administration in Washington, D.C. Mr. Ruediger has served most recently as purchasing agent for the Airtemp division of Chrysler Corp.

HANS A. ALTORFER, formerly associated with Terry Steam Turbine Co., and Allis Chalmers Mfg. Co., has been appointed chief engineer, *NORDSTROM VALVE DIV., ROCKWELL MFG. CO.*, Pittsburgh.

PAUL W. ARNOLD, who has served as manager of product sales, has been appointed to the newly created post of executive assistant to the sales vice president, *RELIANCE ELECTRIC & ENGINEERING CO.*, Cleveland. *RICHARD A. GEUDER*, who has headed the company's application engineering work, is now manager of a new department of applied engineering and industry sales.

DAVID M. FAIRBAIRN has been appointed comptroller of *C. A. DUNHAM CO.*, Chicago. Also assistant secretary of the company, he was auditor prior to this promotion.

JOHN F. SPAULDING is the new sales manager of *THE BLACK & DECKER MFG. CO.*, Towson, Md. Since 1931, he has been manager of the Buffalo branch. He succeeds *GLEN H. TRESLAR*, recently promoted to the post of vice president in charge of sales.

DR. HAROLD L. MAXWELL, supervisor of general consultants, E. I. du Pont de Nemours & Co., has been elected a vice president of the *AMERICAN SOCIETY FOR TESTING MATERIALS*. He will serve through June, 1952.

ROBERT P. BREMNER has been appointed assistant to the vice president in charge of operations for *THE YOUNGSTOWN SHEET AND TUBE CO.*, Youngstown, Ohio. He has been the company's mining engineer.

GENERAL ELECTRIC CO., Schenectady, has formed six new operating divisions, among them *THE MOTOR AND GENERATOR DIV.*, Schenectady, to be managed by *JAMES M. CRAWFORD*; and *THE MEASUREMENTS AND INDUSTRIAL PRODUCTS DIV.*, Lynn, Mass., to be managed by *HAROLD E. STRANG*.

JOSEPH T. MALONEY of *ACME INDUSTRIES, INC.*, Jackson, Mich., will serve the National Production Authority, Washington, D.C., as a commodity industry analyst, for a period of six months to a year. He will return to Acme upon completion of his government assignment.

The new assistant manager, Transite Pipe Dept., *INDUSTRIAL PRODUCTS DIV., JOHNS-MANVILLE CORP.*, New York, is *DON L. HINMON*, since 1948 manager of the aviation industry section of the special industries department.

Remember—

the trade marks "tt" and "TUBE-TURN" are applicable only to products of TUBE TURNS, INC.

It's a neat job...and it's stronger

Write Dept. A-11 for free booklet, "Allowable Working Pressures".

● Welded piping systems are streamlined. They save space, are easier to insulate and are permanently leakproof.

For a complicated connection like this, use of the TUBE-TURN Welding Cross also means extra strength. This welding cross is made from the same seamless tubing and by the same process as TUBE-TURN Welding Tees. Bursting pressures obtained in tests of representative tees and crosses have averaged more than 25% higher than required by standard codes. This gives you extra quality at no extra cost.

Welding your piping with TUBE-TURN Welding Fittings means a neater design and stronger construction. Get in touch with your nearby TUBE TURNS' Distributor. There's one in every principal city.

Be sure you see the double "tt"

TUBE TURNS, INC. LOUISVILLE 1, KENTUCKY

DISTRICT OFFICES: New York • Philadelphia • Pittsburgh • Chicago • Houston • Tulsa • San Francisco • Los Angeles
TUBE TURNS OF CANADA LIMITED, CHATHAM, ONTARIO... A wholly owned subsidiary of TUBE TURNS, INC.

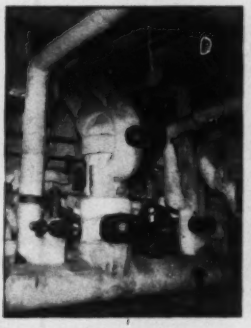
50 miles of *permanent piping* in world's tallest building

● In construction of the Empire State Building, designers wanted to eliminate piping maintenance.

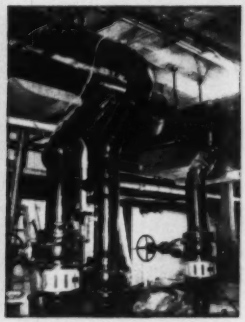
That's why a welded piping system, using TUBE-TURN Welding Fittings, was specified for all critical lines, employed for heating, refrigeration and other services. The original, and additional piping since added, continues to give leakproof permanence.

That's mighty important when you consider that the structure has 50 miles of piping, which last year delivered 72,000,000 pounds of steam, in addition to other services. Moreover, the system has conserved space, and provided optimum flow conditions.

Workman applies finishing touches to insulation on new 12" chill water lines. Note ease of applying insulation on TUBE-TURN Welding Elbows. With no flanges to work around, piping can be much more compact.



Steam header fabricated with TUBE-TURN Welding Fittings feeds 8", 10", and 14" lines with steam at 150 psi. From central heating plant, steam flows to steam stations for distribution to different areas.



New water cooling plant will supply tenants with modern air conditioning facilities. Here, use of TUBE-TURN Welding Elbows and Welding Reducers simplifies piping to refrigeration machinery, and assures a leakproof system. Plant will eventually develop 3500 tons of refrigeration.

DISTRICT OFFICES

New York	Houston
Philadelphia	Tulsa
Pittsburgh	San Francisco
Chicago	Los Angeles

Be sure you see the double "tt"

TUBE TURNS, INC.

LOUISVILLE 1, KENTUCKY

TUBE TURNS, INC., Dept. A-11
224 East Broadway, Louisville 1, Kentucky

Your Name .....

Position .....

Company .....

Nature of Business .....

Address .....

City ..... *State* .....

JOHN M. DUMSER, connected with the copper and brass fabricating industry since 1927, has been appointed assistant to the general sales manager, *WOLVERINE TUBE DIV., CALUMET AND HECLA CONSOLIDATED COPPER CO.*, Detroit.

DON V. PETRONE, vice president since 1947, has been appointed executive vice president of *TYPHOON AIR CONDITIONING CO., INC.*, Brooklyn. The company's new sales manager is *JOHN E. YORK*, who has been district sales manager for the New York and New England territory during the past three years.

KAISER ALUMINUM & CHEMICAL CORP., Oakland, has elected *EDGAR F. KAISER* a member of the board of directors, and *WILLIAM P. B. MARKS* vice president and secretary. Mr. Kaiser is president of Kaiser-Frazer Corp., and Mr. Marks, is vice president in charge of the legal department of Henry J. Kaiser Co.

The new advertising and sales promotion manager of *KRESNO-STAMM MFG. CO., INC.*, Pallisades Park, N.J., is *LEONARD SILVERMAN*, who has been assistant advertising manager of Standard Motor Products for the past six years.

ALEX H. BANKO has been appointed director of sales for *PAYNE FURNACE DIV., AFFILIATED GAS EQUIPMENT, INC.*, Monrovia, Calif. Most recently he has been manager of Bryant Heater Division's Cleveland sales branch.

CHRIS KURZWEIL has been elected vice president in charge of manufacturing for *MYSTIK ADHESIVE PRODUCTS*, a division of Chicago Show Printing Co. . . . . *W. R. MEIKLE* has been placed in charge of heavy steel defense production for the Middletown, Pa., steel boiler plant of *THE NATIONAL RADIATOR CO.*

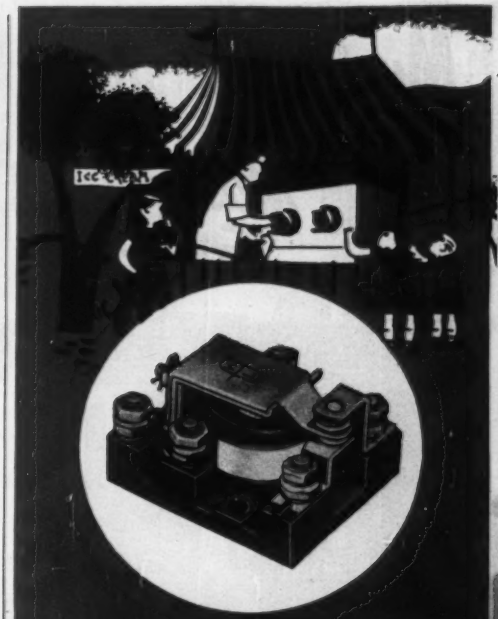
ALAN B. CAMERON, since 1947 vice president and general manager, has been elected president of *RUUD MFG. CO.*, Pittsburgh, succeeding *RICHARD H. LEWIS*, who will remain active as chairman of the executive committee of the board of directors.

JAMES B. ARMSTRONG is the new assistant division credit manager, *SPANG-CHALFANT DIV., THE NATIONAL SUPPLY CO.*, Pittsburgh. In the company's sales accounting organization, *H. C. WITHERSPOON* has been named chief division accountant, and *PAUL L. CORFMAN* is now a division accountant. *F. E. ENGEL*, office manager, has new duties which include supervision of all service functions in the Gateway Center headquarters.

. . . IN THE TERRITORIES

For *GENERAL CONTROLS CO.*, Glendale—*ROBERT C. SERVAT* has been appointed branch manager of the new New Orleans office at 425 Audubon Bldg., and *ELDON BURNETT* has been named manager of the newly opened branch at Omaha.

For *PERFEX CORP.*, Milwaukee—*GEORGE A. WILLIAMS, JR.*, is now district representative for Ohio.



LITTLE RELAY OUSTS BIG STARTER

and saves customer both space and money

An ice cream freezer manufacturer* was perfectly content with the across-the-line starters used in his equipment.

But we got the idea of saving him some room and dollars by substituting Ward Leonard heavy-duty midget *relays.*

It's a really rugged relay, and certain types are Underwriters' listed as motor controllers. Months of testing proved that a standard Ward Leonard relay with just slight changes would do the job of the heavier starter.

It's another case of Ward Leonard "Result-Engineering" Write us for Bulletin 105 on the heavy-duty midget relay, or for *any* control problem, write WARD LEONARD ELECTRIC CO. 24 South Street, Mount Vernon, N. Y. Offices in principal cities of U. S. and Canada.

*Sweden Freezer Manufacturing Company, Seattle, Washington.

WARD LEONARD ELECTRIC COMPANY

Result-Engineered Controls Since 1892

RESISTORS • RHEOSTATS • RELAYS • CONTROL DEVICES

Mueller Climatrol Gas Boilers Must be Good!

Type 20 Gas Boiler — from 315,000 to 3,780,000 Btu for steam and hot water.

They're Triple Tested

to assure continued, trouble-free performance

Yes, every Mueller Climatrol boiler is hydrostatically *tested three times* before shipment—at three separate stages of manufacturing. When these boilers leave the factory, they are right! No wonder Mueller Climatrol Boiler installations are renowned for trouble-free operation and long life.

Mueller's sectional design gives you close-to-size capacities for any job; check these advantages:

- Wide range of residential and commercial sizes — from 54,000 to 3,780,000 Btu input.
- Cast iron, sectional. Precision-machined gas-tight flue passages. Maximum heat transfer.
- Patented V-venturi; cast-iron burners; easily accessible.
- Modern, attractive styling. Easily cleaned through access panel without removing casing.
- American Gas Association approved, conform to ASME Code. Backed by 26 years gas boiler manufacturing experience.

Choose Mueller Climatrol gas boilers for all your steam or hot water heating or hot water supply jobs — it really pays. Write for complete details. *L. J. Mueller Furnace Company, 2023M W. Oklahoma Avenue, Milwaukee 15, Wisconsin.*

94th Anniversary

Mueller Climatrol

For *BABCOCK & WILCOX TUBE CO.*, Beaver Falls, Pa.—a new local district sales headquarters at 712 Eleventh St. It was formerly located at the plant.

For *JOHNSON SERVICE CO.*, Milwaukee—a new branch office in South Bend. *ANDREW J. HUNTER*, formerly of the Chicago branch, has been named sales engineer in charge.

For *BROWN INSTRUMENTS DIV., MINNEAPOLIS-HONEYWELL REGULATOR CO.*, Minneapolis—*W. J. BLACKBURN* is the new industrial manager of the Denver office, succeeding *DONALD W. LARCEN*, recalled to active military duty. *DONALD D. BAKER* is industrial manager of the Kansas City office, succeeding Mr. Blackburn, and *JACK F. SMITH* is industrial manager at Tulsa.

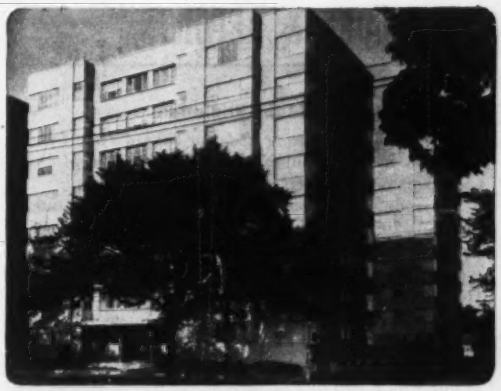
For *IRON FIREMAN MFG. CO.*, Cleveland—*GEORGE ARMOUR*, formerly manager of the central region, has been appointed manager of the northwest region. Replacing him in his former post is *C. F. MERRICK*, previously a district sales manager in the central region. *W. J. FRITZ*, who has been a district sales manager in the Pacific Coast region, is now manager of that region, and *GEORGE L. BEAUREGARDE* is now district sales manager in the region, with headquarters in Walla Walla. The company is reopening its southern regional office, 607 Haas-Howell Bldg., Atlanta, which will be headquarters for *E. V. CROSSIN*, recently appointed manager of the region, *HUGH SMITH*, field engineer, and *J. H. MERRITT, JR.*, southern industrial sales manager.

For *CARRIER CORP.*, Syracuse—the New York district dealer sales manager, *DAVID W. HOPPOCK*, has returned to his post after almost a year's leave of absence in Washington D.C., where he worked for the National Production Authority and the Defense Production Administration.

For *BUSH MFG. CO.*, Hartford—a number of new sales engineers. *E. R. RAMSEY* is assigned to the western New York territory, with headquarters in Rochester. *D. L. ADKINS* will cover the District of Columbia, Maryland and Virginia, with headquarters in Washington, D.C. The new sales engineer for Michigan and the upper Ohio territory is *A. A. LINCOLN*, with headquarters in Detroit. Representing both Bush and *THE HEAT-X-CHANGER CO.*, New York, are *PERLEY K. BARKER*, sales engineer for the eastern New England area, and *C. T. CAVANAUGH*, assigned to the western New England and northeastern New York area.

For *BURNHAM CORP.*, Irvington, N.Y.—a new sales manager for the New York branch, *RALPH S. BRENAN*, who has been assistant sales manager of Spencer Boiler Co.

For *ACRO MFG. CO.*, Columbus—two new field representatives. *RALPH McCORT* has been assigned to Michigan and northern Indiana, with headquarters in Lansing. *AL UNETIC* will cover Ohio and southern Indiana, and will work out of the company's Columbus headquarters.



Washington's Lencshire House Air Conditioned by

FRICK

The 126 apartments in this new 8-story building on Wisconsin Avenue are kept cool and comfortable by three Frick refrigerating machines. Evaporative condensers, placed on the roof, save 95% of the water otherwise required.

Installation by Harvey W. Hottel, Inc., Frick Distributors at Washington, D. C.

Lencshire House was built and is owned by The Lenkin Construction Co.

A Frick air conditioning unit (of 5 or 7½ hp. size) or a central system like that at Lencshire House, will increase profits in your business. Consult your nearest Frick Branch Office or Distributor today.

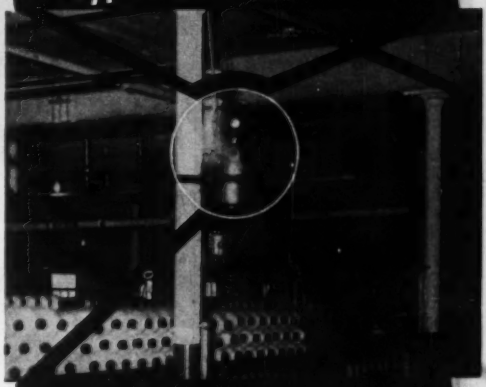
DEPENDABLE REFRIGERATION SINCE 1882

FRICK CO.

WAYNESBORO, PENNA. U.S.A.

Also Builders of Power Farming and Sawmill Machinery

Question: What about Unit Type Steam Humidifiers?



Answer:

Armstrong Unit Type Steam Humidifiers are ideal for overcoming wintertime dry air conditions for the following reasons:

- **Fully Automatic.**
- **Accurate Control**—within 1%—2% relative humidity
- **Clean**—no residue in the air
- **Quiet**—acoustically designed
- **No cooling effect**—raise room temperature a degree or two
- **Economical to operate**—pennies per day per unit—½ to ¼ the price of water spray equipment
- **Low in first cost** approximately $182 complete for a unit to handle up to 40,000 cu. ft.
- **Easy to install anywhere**—hooked up to existing steam and electrical systems much like unit heaters
- **Dependable**—quality materials and workmanship
- **Guaranteed**—complete satisfaction or your money back. Write today.

ARMSTRONG MACHINE WORKS
874 Maple Street, Three Rivers, Mich.

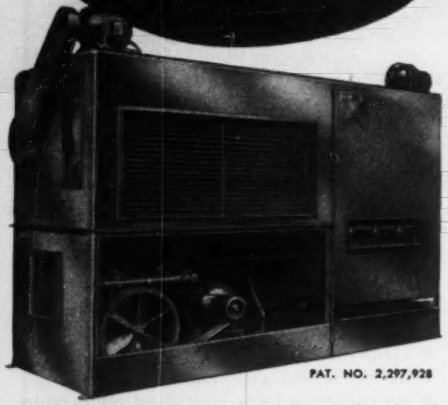
For Full Details Send for BULLETIN 1773

Operating principles, capacities, sizes, prices, hookups, selection data and other useful information — all included in Bulletin 1773. Send for your copy today.

ARMSTRONG *Steam* HUMIDIFIERS

BUILT BY THE MAKERS OF ARMSTRONG STEAM TRAPS

For day in, day out
DEPENDABILITY
you can't beat a
GOVERNAIR
COMPLETELY PACKAGED
AIR CONDITIONER



PAT. NO. 2,297,928

Name your job . . . any air conditioning job requiring from 3 to 50 tons . . . and you'll find that you can't beat a Governair system for day in, day out dependability.

Governair Packaged Air Conditioners are designed to operate at peak efficiency—with all parts precision-matched to work together. And they're built to give years and years of low-cost, trouble-free service.

Choose Governair . . . and you choose the best!

AIR CONDITIONERS | EVAPORATIVE CONDENSERS | COOLING TOWERS | UNIT COOLERS | BLAST COILS FOR HEATING AND COOLING

GOVERNAIR

NEW BOOKS & REPORTS

IBR Code for Finned Tube Radiation

IBR Testing and Rating Code for Finned Tube Type of Radiation has been published by The Institute of Boiler and Radiator Manufacturers.

The code was adopted by members of the institute on May 15, 1951, for the purpose of providing a reliable and uniform procedure for measuring the output of all types of finned tube radiation, regardless of the material from which they are made.

The term "finned tube type of radiation," as used in this code, applies to steam or water heated room heaters composed of a finned tube element fabricated from metallic tubing with a plurality of metallic fins attached to the tubing by means of a mechanical or other type bond. These heaters are designed for installation bare, or with open type grilles, covers, or enclosures having top, front or inclined outlets. The term "finned tube type of radiation" does not include room heaters having this type of heating element which are designed with enclosures to replace the conventional baseboard and which are covered by the *IBR Testing and Rating Code for Baseboard Type of Radiation*. Nor does it include room heaters, commonly called "convectors," which are designed only for installation in an enclosure and which are covered by *Commercial Standard CS* 140-47.

Tests under the new code, it is explained, may be conducted in the manufacturer's laboratory or in a laboratory selected by the manufacturer. All observations taken and the results obtained during the tests must be submitted to the institute, in triplicate, on forms provided for that purpose. Upon receipt of the data by the institute, it is reviewed by the finned tube rating committee, appointed by the institute, to determine whether the tests have been conducted in accordance with the provisions of the code and whether approval of the requested IBR ratings is warranted.

It is not necessary that a manufacturer be a member of the institute in order to obtain approval of IBR ratings and to use the IBR emblem. A license is executed between the manufacturer and the institute specifying the conditions under which such ratings and the emblem may be used. No manufacturer has the right to use IBR ratings or to state that his products have been tested in conformance with the procedures outlined in the code unless and until he has received written authority from the institute to use the IBR emblem as applied to the specific, approved IBR ratings.

IBR ratings on finned tube type of radiation may be accepted with the same confidence as exists with respect to IBR ratings on boilers and baseboard type of radiation.

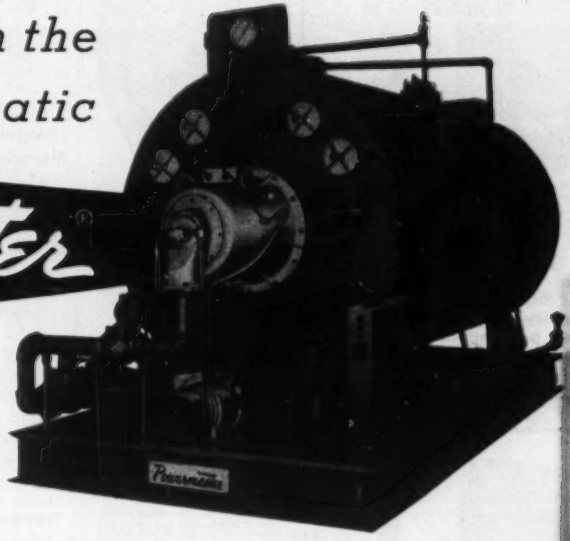
Requests for license or inquiries regarding this code should be addressed to The Institute of Boiler and Radiator Manufacturers, 60 East 42nd Street, New York 17.

Summary of Research on Baseboard Heating

"Room air temperature variations are affected by the length of the operating cycle of the burner and the circulator. From the standpoint of uniform room air tem-

now you can reduce steam costs with the automatic

Powermaster®



Model 3 *Powermaster* — 15 to 500 H.P.; high or low pressure models for steam or hot water.

Exclusive burner design (patent applied for) is yours with the *Powermaster* steam generator. Compare this unit with others and you'll see why users are saving hundreds of dollars on fuel bills. Only the *Powermaster* gives you these 3 definite ways to reduce your costs for steam or hot water—

1. *Use less fuel* when boiler operates between 100% and 30% of capacity. Special burner gives you full modulation in a wide range between high and low fire.

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3. *Change from oil to gas* (or gas to oil) in just a few minutes. Take advantage of low fuel rates, enjoy freedom from worry about fuel shortages.

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that gives you the entire story of the *Powermaster* steam generator. Just ask for Catalog 1218 and we'll put one in the mail for you.

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are reading this message. It tells why the Powermaster gives outstanding performance for

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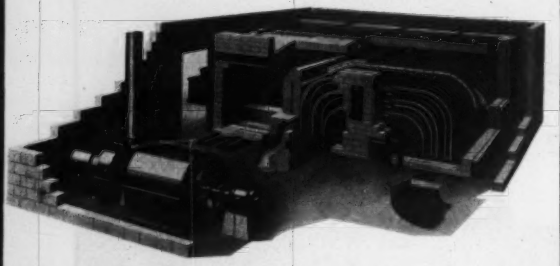
We'll be glad to send you more information.

LEE

BRICK-SET TUBULAR HEATER



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Model BST Brick-Set Tubular Heater, Capacity 2,000,000 b.t.u. to 10,000,000 b.t.u. for permanent central heating installations. The finest space heater ever manufactured.

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Model VTH Vertical Tubular Heater, Capacities 2,000,000 b.t.u. to 6,000,000 b.t.u. Can be used with or without duct distribution. Portable — requires no special foundation. Ideal for pre-heating large volumes of replacement air.

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Model HD "Packaged" Unit Heater, Heavy duty capacities 300,000 b.t.u. to 2,000,000 b.t.u. Portable. Automatic for oil or gas or combinations. Completely factory assembled and tested.

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perature, short and frequent cycles of operation are preferable to longer, less frequent cycles." This and similar findings are outlined in a new bulletin, *Radiant Baseboard Heating and Effects of Reduced Thermostat Setting and Open Bedroom Windows at Night*, the seventh in a series of bulletins covering a cooperative research program carried on by the Engineering Experiment Station of the University of Illinois, and the Institute of Boiler and Radiator Manufacturers. The authors, W. S. Harris and R. H. Weigel, describe the performance characteristics of types R and RC radiant baseboards.

Copies, at 70 cents each, may be obtained from the experiment station, Urbana.

Manual on Preparing Technical Material for Publication

A new University of Illinois Engineering Experiment Station bulletin (circular series No. 62), *Preparing Technical Material for Publication — A Manual for Authors of College and Station Publications*, covers the general form of station and college publications (title page, tables, figures, etc.), and the contents of station publications (adjusting to readers, using language effectively, etc.). The authors, L. A. Rose, director of engineering information and publications, E. F. Heater, research associate professor, and G. R. Foster, assistant editor, engineering experiment station, also give instructions for preparing the manuscript and the illustrations, and for proofreading.

Copies may be obtained from the experiment station, Urbana, at 60 cents each.

Standard for Acoustical Terminology

Sound transmission and propagation, shock and vibration, and general and architectural acoustical terms are among the topics covered in the *American Standard Acoustical Terminology*, Z24.1-1951, sponsored by the Acoustical Society of America in cooperation with the Institute of Radio Engineers, Inc., and approved and published by the American Standards Association.

Copies are available from the ASA, 70 E. 45th St., New York 17, at $1.50 each.

OTHER BOOKS AND REPORTS RECEIVED

THE EFFECTS OF WARMTH ON COMFORT AND EFFICIENCY and *PHYSIOLOGICAL STUDIES OF THE EFFECTS OF HEAT*—These two papers, which were presented at a March conference of the Medical Research Council, Great Britain, are incorporated in the bulletin, *The Application of Scientific Methods to Industrial and Service Medicine*, comprising the entire proceedings of the conference. The first paper, by T. Bedford, covers the effects of heat on efficiency in various trades, and traces the relationship between temperature and accident liability. The second paper, by J. S. Weiner, discusses the thermal stress of hot environments and acclimatization to heat (including the practical aspects of this for setting up working conditions).

The proceedings are published by The Stationery Office, and may be obtained from York House, Kingsway, London W. C. 2. The price is three shillings (which would be approximately 50 cents, including return postage).

Why more than 1000 architects sent for this booklet after the first announcement

four helpful articles

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acoustics by Vesper A. Schlenker
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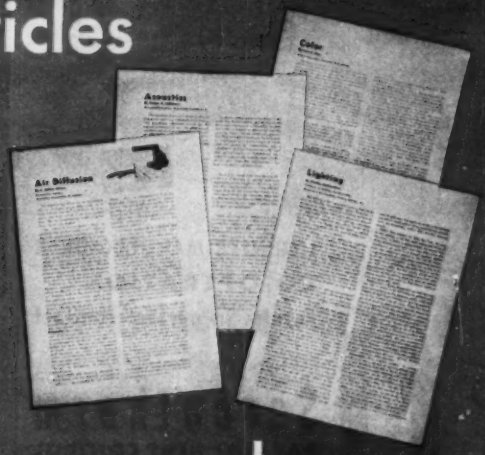

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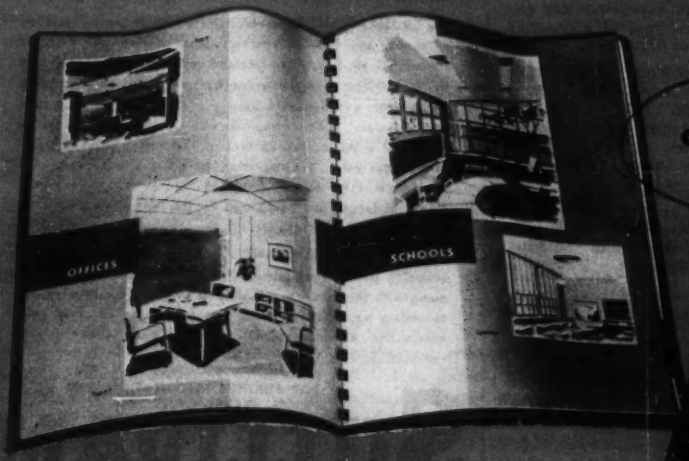

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York County Home Annex, York, Pa. Architect: Clair S. Buchart, York, Pa. Engineer: William K. Hood, York, Pa. Heating Contractor: C. C. Kottcamp & Son, York, Pa. Floor type Radiant Heating System divided into 13 zones, each controlled by type STA-1 Sarcotherm controls and "Thermoray" comfort thermostats.

ENGINEER-MANUFACTURER CO-OPERATION results in perfect comfort

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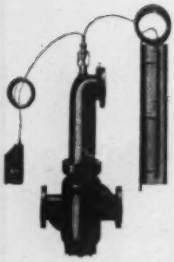

● The heart of the Sarcotherm control system for radiant or forced hot water heating is this unique control valve. It is actuated by liquid expansion thermostats, one located outside the building and one in the valve itself. Between them they anticipate changes in heat loss ratio, thus maintaining comfort temperatures under all conditions.

Here is a striking example of the advantages of close cooperation between the architect's designing engineer and an equipment manufacturer who not only offers complete weather compensated control systems for hot water and radiant heating, but can supplement this with 30 years' experience and the most complete line of accessories for all types of heating.

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An important feature of the control system is the unique "Thermoray," a very sensitive heat loss thermostat, influenced by both radiation and convection.

Sarcotherm also regulates supplementary baseboard heating, and unit heaters.

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22-A

● The Sarcotherm Comfort Control "Thermoray" is an extremely sensitive thermostat effected by both radiation and convection.

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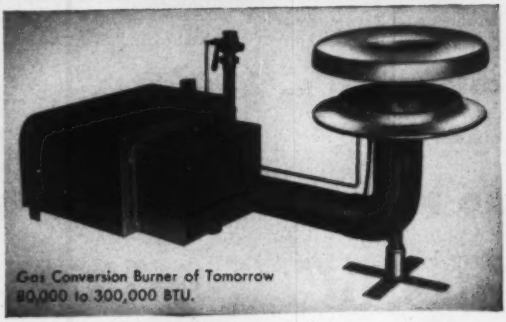

Gas Conversion Burner of Tomorrow 80,000 to 300,000 BTU.

The TRULIRADIANT CONVERSION BURNER can be installed in almost any furnace whether square or round, gravity or forced hot air, hot water or steam with an input capacity up to 300,000 Btu. The conversion burner consists of a complete burner with an adjustable base and cast iron telescope tube and a safety pilot (complete with tubing). The controls consist of a thermostat, 25 feet of thermostat cable, a transformer, gas valve, gas regulator, main line shut-off valve and pilot cock. We do not furnish a limit switch. The burner height or length can be altered by the readjustment of a set screw and a locknut.

The unique TRULIRADIANT ADJUSTABLE ORIFICE makes precision gas flow adjustments extremely simple. This factor, along with the accurate adjustments available for primary and secondary air, makes it possible to achieve, in all cases, peak combustion efficiency and economy which follows proper combustion.

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MEETINGS & CONVENTIONS

7th ALL-INDUSTRY REFRIGERATION AND AIR CONDITIONING EXPOSITION—November 5 to 8, Navy Pier, Chicago. Sponsored by the Refrigeration Equipment Manufacturers Association, 1346 Connecticut Ave., N. W., Washington 6, D. C.

INDUSTRIAL HYGIENE FOUNDATION, 4400 Fifth Ave., Pittsburgh 13—16th annual conference, November 14 and 15, Mellon Institute, Pittsburgh. Chief topic will be better health conditions for management.

CANADA'S 1951 *POWER SHOW*—November 26 to 29, Royal York Hotel, Toronto. Sponsored by the Institute of Power Engineers, 496 Church St., Toronto. To be held in conjunction with the institute's annual convention.

CONFERENCE ON LABORATORY DESIGN FOR HANDLING RADIOACTIVE MATERIALS—November 27 and 28, Washington, D.C. Co-sponsored by the American Institute of Architects and the U.S. Atomic Energy Commission, and conducted by the Building Research Advisory Board of the National Research Council, 2101 Constitution Ave., Washington 25, D.C. Among the subjects to be presented are:

The Design of Laboratory Facilities for Research with Radioactive Materials at Various Levels, by Alexander Mackintosh.
Air Supply and Exhaust for Laboratories Handling Radioactive Materials, by Carleton P. Roberts.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS, 40 W. 40th St., New York 18—Annual meeting, December 2 to 5, Hotel Roosevelt, New Orleans. Includes conference on packaged air conditioning, which will cover, among other topics, room air conditioners and self contained air conditioners.

NATIONAL HEATING WHOLESALERS ASSOCIATION, 609 Union Commerce Bldg., Cleveland 14—Annual meeting, December 3 and 4, Statler Hotel, Cleveland.

NATIONAL WARM AIR HEATING AND AIR CONDITIONING ASSOCIATION, 145 Public Square, Cleveland 14—Annual convention, December 5 and 6, Hotel Cleveland, Cleveland. Program will include information on technical advances affecting the industry.

THIRD PLANT MAINTENANCE SHOW—January 14 to 17, Convention Hall, Philadelphia. Registration and hotel information available from Clapp & Poliak, Inc., 341 Madison Ave., New York, exposition management. Exhibitors' list available from Banner & Greif, 250 W. 57th St., New York 19.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, 62 Worth St., New York—58th annual meeting, January 28 to 30, St. Louis. Next International Heating, Ventilating and Air Conditioning Exposition to be held in conjunction with the society's 59th annual meeting, January, 1953, Chicago.

First Federal Housing Project—
at ATLANTA, GA., — 1936

If you will turn back to your June 1936 issue of HEATING, PIPING & AIR CONDITIONING you will find the above photograph at the top of our advertisement.

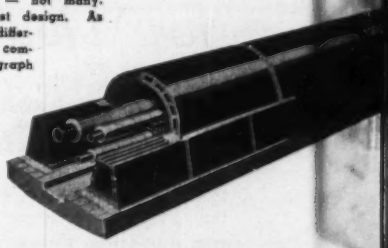
At the time, we were not aware of the importance of the installation. We did not state that it was the FIRST Federal Housing Project. We did not suspect that housing would grow to its present proportions or that Therm-O-Tile usage would develop to its present great volume in projects of all kinds. Yes

THERM-O-TILE
Reg. U. S. Pat. Off.

UNDERGROUND STEAM CONDUIT

was used in the above FIRST Federal Housing Project — 6000 feet of it — to supply heat to 700 families. Since then, Therm-O-Tile has been installed in many other Federal projects, in different sections of the United States, requiring a total of many miles of Therm-O-Tile.

A few improvements have been made in Therm-O-Tile since 1936 — not many. Here we show our latest design. As will be observed, the differences are not great when compared with the photograph above. Therm-O-Tile has ALWAYS been highly efficient, strong, and durable, hence its preference for permanent installations by heating engineers and contractors.



ASK FOR BULLETIN 511 — Bulletin 511, just published, shows and tells about other outstanding projects in which Therm-O-Tile handles the distribution of steam, including First Prize Glen Oaks Village, New York City, a $30,000,000 project. The bulletin also gives complete data concerning Therm-O-Tile.

ASK FOR ADVICE — Our engineers will gladly furnish recommendations, estimates of cost, and complete specifications for the conduit and insulation on any underground pipe line project upon request.

JOHNS-MANVILLE — Therm-O-Tile is represented by Johns-Manville Technical Service Units in all principal cities.

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RECENT TRADE LITERATURE

For your convenience in obtaining copies of these bulletins, see coupon on page 185. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending requests to Heating, Piping & Air Conditioning.

Air Conditioning

HPAC 101—General Electric Co., 5 Lawrence St., Bloomfield, N.J.—60 page manual gives technical information on the application of "Personal Weather Control" unit air conditioning system to multi-room buildings. Selection factors are discussed (type of building, number of windows, etc.), and typical system arrangements, water piping design, high pressure duct system design, electric wiring to room units, and similar topics are covered.

Anti-Rust Paints

HPAC 102—Paint Corp. of America, Fidelity Bldg., Cleveland 14—Bulletin describes the features of black and clear anti-rust paints, and includes complete price information.

Austenitic Nickel Alloy Cast Irons

HPAC 103—The International Nickel Co., Inc., Dept. EZ, 67 Wall St., New York 5—36 page bulletin describes eight types of "Ni-Resist" austenitic nickel alloy cast irons, designed to withstand corrosion, heat, wear and low temperature.

Boiler

HPAC 104—Kewanee Boiler Corp., Kewanee, Ill.—Catalog 99 illustrates and describes the "Scottie Junior" boiler, for 125 lb working pressure, which is designed for applications involving limited headroom and space. Ratings, dimensions, and other data are given for the boiler, which is available in six sizes rated at 7 to 36 hp.

Cable Connections for Electric Welding

HPAC 105—Tweco Products Co., P.O. Box 666, Wichita —Catalog No. 8 illustrates and describes the complete line of electrode holders, ground clamps, terminal connectors, cable splicers, mechanical and solder type cable lugs, etc., and gives information on the maintenance of electric welding cables and connections.

Calibration Service

HPAC 106—Fischer & Porter Co., 5060 County Line Rd., Hatboro, Pa.—Catalog gives details on a calibration service offered by the company, which operates an hydraulics laboratory. Various calibration methods are explained, and the facilities are illustrated.

Combustion Equipment

HPAC 107—Eclipse Fuel Engineering Co., 1139 Buchanan St., Rockford, Ill.—Bulletin illustrates and describes mixers, valves and blowers used in gas combus-

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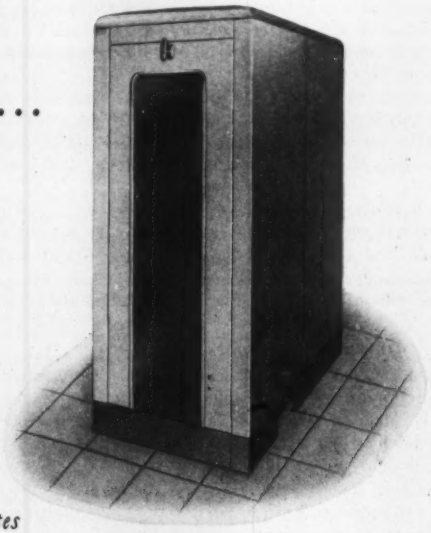
A boiler jacket by Atlas serves two important purposes. First—its functional design cuts installation time to a minimum. Saves labor costs—*increases profits*. Secondly—its beauty of design lightens your sales load—finds new prospects—enlarges your market. Moreover—an Atlas jacket is yours alone . . . built to *your* specifications, designed to best fit *your* market demands.



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3. TYPE "TM" HIGH PRESSURE TURBINE PUMP is designed for pressures up to 150 pounds, and boilers to 250 H. P. See Bulletin No. 17.

4. TYPE "UV" PUMP designed in single and duplex units. Capacities 2,000 to 40,000 sq. ft. E.D.R. Write for Bulletin No. 19-A.

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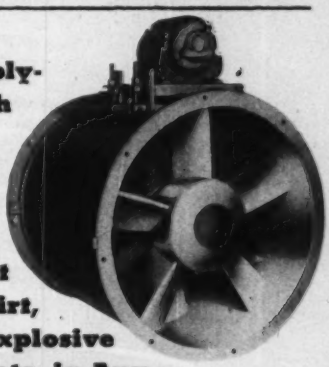
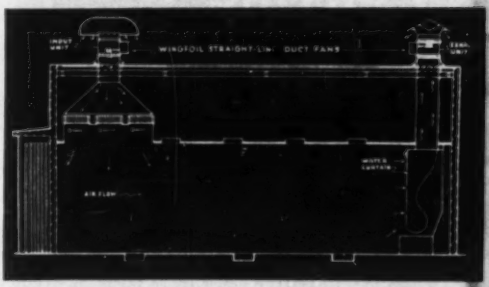
For Supplying Fresh Air or Exhausting Air containing Paint Spray, Dirt, Steam, Explosive Vapors, etc. in Any Volume or Pressure





It may be used as shown above as a roof intake or exhaust, or it may be inserted in a run of duct, occupying no extra space. The motor is located outside the casing, driving the Wingfoil "non-overloading" fan by means of an enclosed V-belt. It is light, compact and easily handled, and may be mounted either horizontally or vertically. *Write for Bulletin F-10.*

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Wing STRAIGHT-LINE • DUCT FANS

tion for industrial applications. Also covered are gas and oil fired steam boilers and furnaces for process industries.

Controls for Heating and Air Conditioning

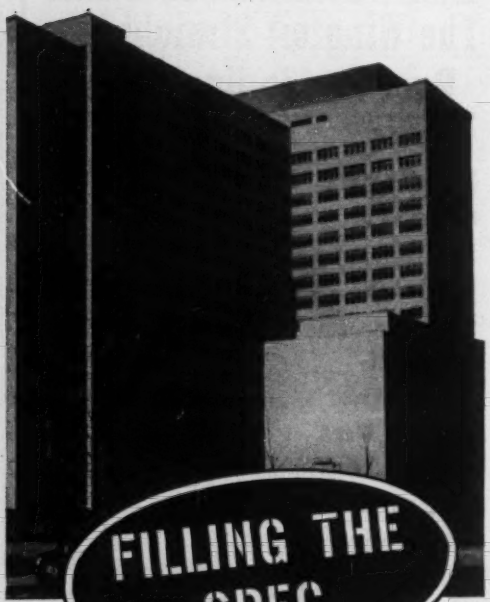
HPAC 108—Barber-Colman Co., Rockford, Ill.—Catalog F-1753-3 gives information on thermostats (room, strap-on, remote bulb, etc.), motor operated valves, solenoid valves, temperature regulators, control motors, unit ventilator controls, packaged zone control systems, outdoor reset hot water controls, electronic controls, etc., and various accessories for ventilating and air conditioning applications. Uses, construction, ratings, dimensions and special features of the equipment are discussed.

Dehumidifiers

HPAC 109—Surface Combustion Corp., 2375 Dorr St., Toledo 1—Bulletin K-51-B is a reprint of a recent article describing the use of "Kathabar" dehumidifiers (which employ lithium chloride solution as a desiccating agent) to control the humidity in air delivered to a penicillin processing plant.

Diaphragm Motor Valves

HPAC 110—Minneapolis-Honeywell Regulator Co., Station 40, Wayne and Windrim Aves., Philadelphia 44—Specification Sheet 419-1 covers the series 100 air operated diaphragm motor valve for narrow band proportional control. Information is given on size, construction, body pressure range, connections and mounting dimensions.



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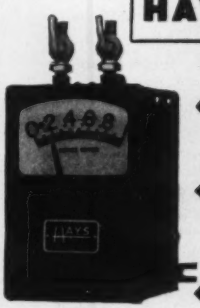

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constant accuracy—with Hays "slack diaphragm", measuring unit retains accuracy. Outside zero adjusting screw provided.

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Get complete details on this accurate indicator of filter efficiency. The Hays Air-Filter Gage measures the actual resistance air meets passing through the filter. You KNOW when it's time to replace. Can be furnished with flash or sound alarms or with damper controls.

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SPECIFICATIONS

The face and blades of model PH-142 are fabricated of 16 gauge steel, the blades are set in a fixed-fan angle degree for even deflection. The frame is of one piece, 18 gauge steel construction. The Louvre box fabricated of 16 gauge steel. Packed one to a box, and 20 to a master carton. Comes handsomely finished in gleaming, durable metallic-lustre.

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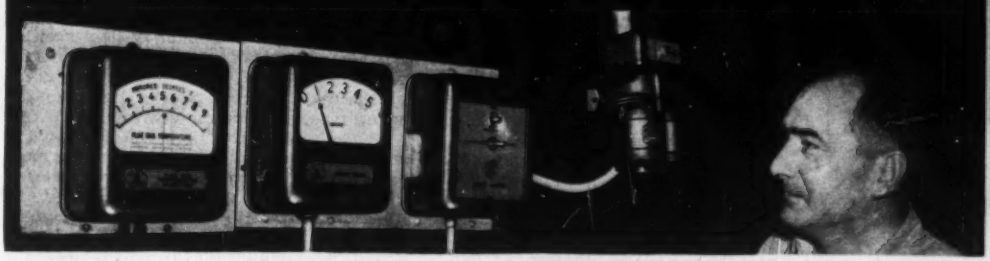

Similar savings can be made on most commercial and industrial heating systems with . . .

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CONTROLS YOU CAN TRUST

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For latest data and prices. Conserve fuel, increase efficiency, save time and money. No obligation!

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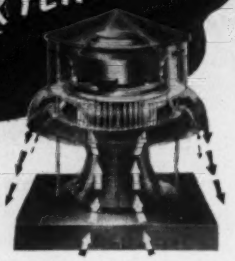
THREE VITAL GALLAHER FEATURES



GALLAHER Air-Van POWER EXHAUSTERS

Pats 2526290 2188741

Certified Ratings Impartial laboratory tests under the direction of a nationally recognized authority covering the entire unit. Capacities 150-11,000 CFM; Static Pressures to 1¾".

Scroll Effect An exclusive built-in Gallaher feature. Maximum efficiency beyond ¼" static pressure is not possible without it.

Safe Fume Handling Motor out of the airstream and a positive air **seal-off** around motor shaft prevents fume passage into motor housing while unit is in operation.

See your Gallaher Representative or write Dept. H. 4108 Dodge St., Omaha, Nebraska

The GALLAHER Company
Omaha, Nebr. Owatonna, Minn.

Flow Signal Transmitter

HPAC 111—Hagan Corp., Hagan Bldg., Pittsburgh 30—Bulletin 2551 describes a pneumatically operated flow signal transmitter for pressure differentials from 5.5 in. water column to 100 psi, with any static pressure up to 1500 psig. It transmits proportional signals to remote recorders or indicators, or to automatic control elements. Application diagrams show its use in measurement of flow, liquid fuel, liquid level and absolute pressure.

Fusion Welding of Nickel and High Nickel Alloys

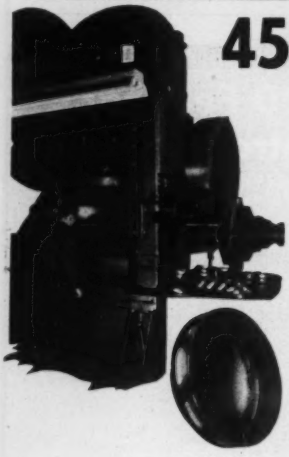
HPAC 112—The International Nickel Co., Inc., Technical Service Section, 67 Wall St., New York 5—Bulletin T-2 (44 pages) gives instructions for various forms of electric arc and gas welding, and offers information on pickling, testing and inspection safety methods, the ASME boiler code, etc.

Gearmotors and Speed Reducers

HPAC 113—Abart Gear & Machine Co., 4834 W. 16th St., Chicago 50—Pocketsized, condensed catalog on speed reducers and right angle gearmotors gives selection data, ratings, ratios and installation graphs.

Hydraulic Remote Control

HPAC 114—Sperry Products, Inc., Danbury, Conn.—Bulletin 20-106 describes an hydraulic remote control which is a single tube, balanced, self-contained system



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30 years of experience in the design and manufacture of heat transfer equipment, and in manufacturing know-how, are back of AUTORAD Finned Radiation. For over a quarter of a century AUTORAD has paced the industry in improvements in engineering and production of heat transfer products such as finned coils, finned pipe, condensers, receivers and evaporators.

Back of this engineering leadership is a plant equipped with the most modern machines and manned by skilled personnel. Massive presses like this, with capacity to form and punch heavy work of large dimensions, are but part of the equipment available to AUTORAD for special production.

The facilities required for manufacturing AUTORAD products are more than ample for all reasonable trade requirements. Production facilities are available as well for the prompt and experienced handling of Government orders.

Write for Form AR-101 and Bulletin 50

AUTO-RAD Inc.

Manufacturers of Heat Transfer Equipment Since 1920

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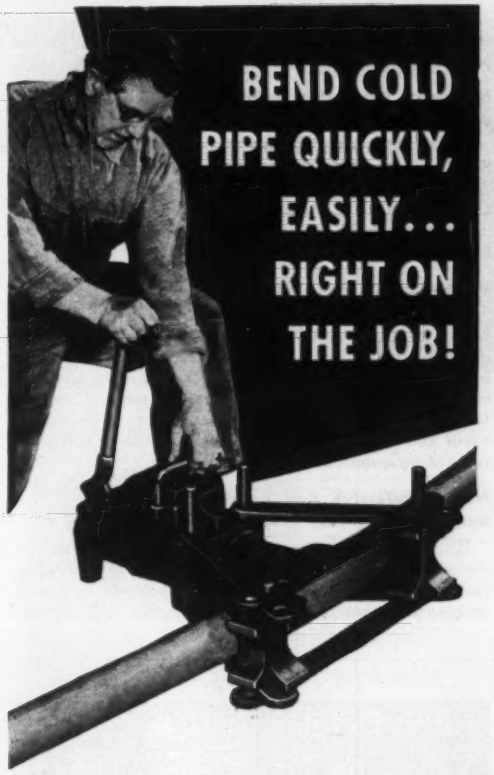

with a GREENLEE HYDRAULIC BENDER

Yes, make pipe bends "right on the job" . . . exactly where and when you need them! And do the job swiftly, accurately with a GREENLEE Hydraulic Pipe Bender.

Bends pipe up to 4½". Simple to operate, easy to carry, set up and shift from job to job. With a GREENLEE *one man* makes smooth, precise, uniform bends in but a few minutes. Speeds your piping installations, cuts costs on labor and materials. In timesavings alone, the GREENLEE pays for itself quickly.

Ideal for radiant heating jobs, too. For complete details write for free Bender Booklet E-201. Greenlee Tool Co., Division of Greenlee Bros. & Co., 2351 Twelfth Street, Rockford, Illinois.

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GREENLEE

for RADIANT BASEBOARD HEATING

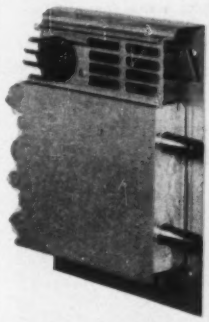
***because:* WHEREVER YOU ARE**
WHATEVER YOUR WEATHER
BE IT BIG JOB OR SMALL

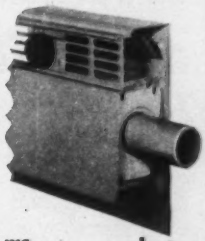
KRITZER gives you every fact you need

. . . to sell, design and install radiant baseboard heating — in its new engineering manual No. 50-CE. Easy to read and follow this "Tell-All" book contains the only reliable certified ratings for every installation. They are both laboratory and job tested and proven.

KRITZER'S LINE has every part needed

. . . for simple, swift installation of radiant baseboard heating, whatever job requirements. Best of all it's easy to select, order and stock. Kritzer engineering means the smallest number of parts for any given job.





KRITZER RADIANT COILS, INC.
2901 W. Lawrence Ave., Chicago 25, Ill.

Here's Your First Step on the Road to Profits with Kritzer Radiant Baseboard Heating.

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IF IT'S KRITZER IT'S RIGHT, SIR!!

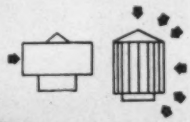
do you know

the TRUTH about ventilators?

Ventilators are usually selected on the basis of their *capacity ratings*. That makes sense, but do you know that:

1. Capacity ratings of most ventilators are *not* certified.

2. Capacity ratings of most ventilators are based on *horizontal* wind tests only.



Breidert Air-X-Hausters

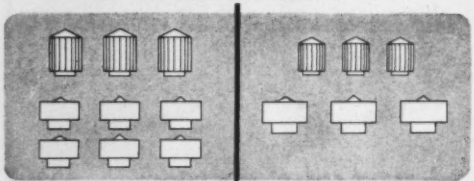
provide safe, sure ventilation no matter which way the wind blows!

Patent No. 2269428

and . . . Breidert Air-X-Hausters are the *only* ventilators with published certified capacity ratings based on tests* made with wind blowing in *all* directions as shown above.

Only such tests can guarantee the capacities a ventilator will deliver under actual operating conditions. No matter which way the wind blows, barring interior negative pressures, the Breidert provides safe, sure ventilation . . . on roofs, vent flues, chimney tops. Stationary, no moving parts, nothing to jam or get out of order.

HOW YOU CAN GET BETTER RESULTS WITH LESS MONEY



It takes fewer Breiderts to do the job as same size conventional ventilators. **(or)** *You can use the same number of smaller size Breiderts to do the same job as conventional ventilators.*

Get *all* the facts! Write today for complete Engineering Data Book, including certified capacity ratings. Address Dep't A.

**By Pittsburgh Testing Laboratories*

THE G. C. BREIDERT CO.

3129 San Fernando Road, Los Angeles 65, Calif.

Representatives in principal cities throughout the U.S.

operating independently (without outside sources of power). It has a maximum rated capacity of 400 in. lb on the pressure stroke, and 125 in. lb on the return stroke.

Industrial Expansion Joints and Aircraft Bellows

HPAC 115—Solar Aircraft Co., 2200 Pacific Highway, San Diego 12—Catalog 51 (48 pages) contains complete data on "Sola-Flex" bellows type expansion joints and aircraft bellows and assemblies. The bellows assemblies range in pipe size from ½ to 72 in., covering pressures from vacuum to 1000 lb.

Instantaneous Hot Water Heaters

HPAC 116—Patterson-Kelley Co., Inc., East Stroudsburg, Pa.—Catalog 202 gives dimensions and a number of capacity tables (based on forced circulation) for U tube instantaneous hot water heaters. Data also is given on condensate coolers, hot water service heaters (two-pass for gravity circulation), and booster heaters. Reclaimers, vapor and "Freon" condensers, fuel oil heaters, and other types of equipment are illustrated.

Metal Protective and Paint Bonding Chemicals and Processes

HPAC 117—American Chemical Paint Co., Ambler, Pa.—Reference list (with descriptions) of rust proofing, paint bonding and metal protective chemicals and processes covers coatings, cleaners, etc., for steel, iron, zinc and

Latest Developments in Control Valves for Air · Gases · Liquids

yours for the Asking

Write us to receive copies monthly

The W. S. Rockwell Valve News describes new developments in Rockwell automatic and manually controlled Butterfly Valves, Slide Valves and valves of special design for use in plant piping, ducts and processing equipment for control and shut-off of steam, cooling water, air and flue gases.

It presents interesting ideas in design, construction, method of valve operation, and is helpful in sizing up your valve needs.

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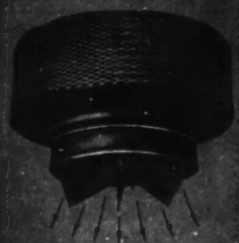
BLAST HEATING COILS—AIR CONDITIONING COILS—ALL TYPES

All copper spiral fin tube construction with the tubes formed or bent permits uniform expansion without strain. Headers are heavy wall construction with tubes brazed into extended ferrules formed in the headers. Fins are helically wound and metallically bonded. May we send catalog?

VERTICAL TYPE UNIT HEATERS



A proven heating unit, modern in design, incorporating every unit heater advancement. McCord copper spiral fin tube construction creates air turbulence without undue restriction. Improved fan blades deliver large volume of air with minimum air noise. Guaranteed for 150 lbs. saturated steam pressure. Specify McCord.

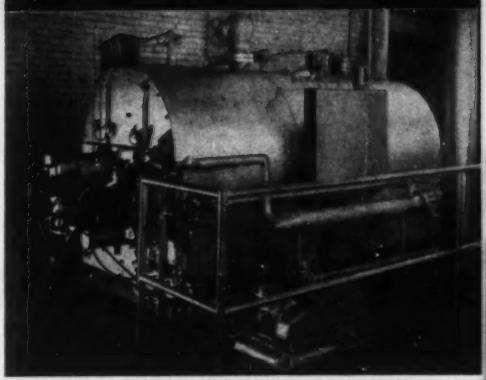
HORIZONTAL TYPE UNIT HEATERS

A time proven heating unit, modern streamlined in design, quiet, yet its rugged construction adapts it to all types of installations, guaranteed for use on No. 150 p. s. i. steam pressure. All copper heating element, individual spiral fin tubes free to expand without strain on joints. Standard motors with standard bases used. Wide range of capacities.

Save fuel with McCord Unit Heaters.

McCord CORPORATION
DETROIT 11, MICH.

This 100 H.P. Dutton EconoTHERM SAVES $20 PER DAY!



That's on fuel alone, reports McInerney Spring & Wire Co., of Grand Rapids, Michigan

How can *you* save on steam generation costs? Consider this case: During winter, McInerney operates two 300 H.P. boilers for processing and heating. From spring to fall, one boiler supplied processing steam only.

Two years ago, analysis showed that one 100 H.P. oil-fired EconoTHERM would provide plenty of steam for processing. After this "packaged" unit was installed, *over $20 per day savings on fuel alone resulted* — throughout five to six months each year!

Labor costs also dropped astonishingly. Because the EconoTHERM is automatically operated, a few hours per week suffice to check the boiler, burner and controls. Formerly, a full-time attendant was needed. McInerney was "highly pleased" — and we're confident you'll be equally pleased with EconoTHERM performance!

Your case may be very different

. . . yet Dutton may help you discover some highly important savings! Find out why the EconoTHERM's exclusive off-center firing gives you faster steaming — greater safety — and lower cost.

WRITE NOW FOR ECONOTHERM BULLETIN EC-100G

Other types and sizes — 5 to 250 h.p.

See Yellow Pages in Phone Book for Dutton Representative

Dutton BOILER DIVISION
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Boiler Makers Since 1880

How to promote greater PER-MAN productivity!

Well-ventilated working environments contribute to faster, better defense production.

Western Rotary Turbine Ventilators provide constant, round-the-clock exhaust *without power*. A 2-mph breeze keeps your Western Rotary System in operation. Lifetime guaranteed bearings are both mounted on the same axis . . . always stay in alignment. Throat sizes 6" through 48", with the clean, low silhouette progressive industry demands.

Complete, up-to-the-minute information, sizes, capacities, and prices on all Western equipment upon request. In 1951 SWEETS and A.E.C. AVAILABLE FROM YOUR FAVORITE WHOLESALER'S STOCK.

"ALWAYS ON THE JOB — NEVER ON THE PAYROLL"

WESTERN ENGINEERING & MFG. CO.
1726-28 E. WASHINGTON BLVD., LOS ANGELES 21, CALIF.

aluminum. There are also brief descriptions of chemicals used in polishing copper and brass, in stripping copper, and in other applications.

Metallizing Guns

HPAC 118—Metallizing Engineering Co., Inc., 38-14 30th St., Long Island City 1—Bulletins 94 and 95 describe, respectively, the type 4E gun for high speed spraying with all metals, and the type 5E gun for hand spraying in corrosion protection work. The first is designed for spraying all wires from 20 B&S gage to ⅛ in.; the second, for 3/16 in. wire. Both guns incorporate a patented jet siphon principle in the gas head, which automatically compensates for variations in gas pressure as high as 10 lb, and automatic control of wire feed which compensates for kinks, reel stand drag, etc., the manufacturer states.

Motors

HPAC 119—Allis-Chalmers Mfg. Co., 1171 S. 70th St., Milwaukee—Bulletin 05B7648 describes the standard construction features of low speed, coupled type, pedestal bearing synchronous motors, in ratings of approximately 100 hp and more at speeds of 450 rpm or less. They can be used for direct-coupled drives in various types of pumps, ventilating fans, and other industrial equipment.

O Rings

HPAC 120—O Ring Technical Service Dept., Arrowhead Rubber Co., Downey, Calif.—*O Ring Data Sheet* is a

BETTER BUILT UNITED
COOLING TOWERS

For All Refrigeration and Air Conditioning Requirements

This 700 G.P.M. United tower serves the air conditioning system of a large Midwest hotel. It is deck filled, sheathed with cement-asbestos board and equipped with low pressure sprinkler distribution.

- Individually designed mechanical draft towers of any required capacity for the larger installations.
- Standardized, prefabricated "package" type units of 5 to 30 tons refrigeration for the smaller jobs.

Complete details of design and construction in Bulletin No. 50, showing typical United installations in all fields . . . Power, oil, gas and refrigeration. Write for it today.

UNITED COOLING TOWER COMPANY
Porter Bldg. — Authorized Representatives in Principal Cities — Kansas City 2, Missouri

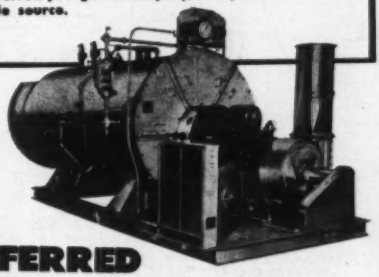
ONLY PREFERRED Offers Lowest Installation Costs

That's right! To install a Preferred Horizontal Rotary Oil Burner costs less than any other industrial oil burner. Exclusive and patented features cut time and labor needed for wiring, brickwork and piping. For example, all basic burner components are completely wired to the terminal junction box. Preferred has been able to lower installation costs because of their years of experience as a dealer, installer and distributor of oil burners. And they have put this practical experience to work for you.

Originally designed to meet the exacting requirements of the Preferred Unit Steam Generator, its fully automatic operation with residual fuels proved so successful that it has won wide acceptance for conversion applications.

It is available with associated Preferred products such as enclosed, pre-wired, union approved panels as well as pump and heater sets where applicable.

At Preferred you get all major job requirements from a single source.



PREFERRED Unit Steam Generator

The Preferred Unit Steam Generator is a custom-built boiler designed to maintain its guaranteed efficiency for a quarter of a century with a minimum of maintenance. It is the result of 28 years of combustion experience combined with the latest technical advances in pressure vessel design. That is why the Preferred unit offers the lowest installation cost, greatest economy and longest life of any steam generator.

Write for Burner Bulletin 175, Generator Bulletin 1000 and material cost estimates on your application.

PR-301

PREFERRED UTILITIES MANUFACTURING CORPORATION

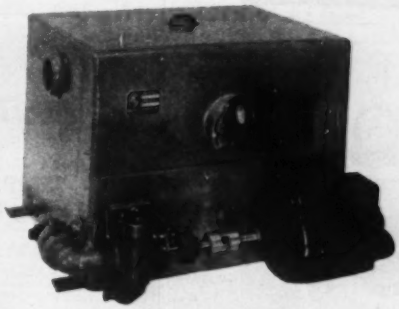
1860 BROADWAY, NEW YORK 23, N. Y.

PUMP ? STUMPED

an

EAGAN PUMP

is the answer



"Illustrated above is the **Eagan "Eagle"** versatile unit, handling 8,000 sq. ft. at 20 P.S.I. and selling for a trade price of **$139.00** F.O.B. Philadelphia.

Eagan Standard Units are made in single and duplex models to 150,000 sq. ft. E.D.R. at pressures to 200 P.S.I.

Your pump problems are invited. Eagan engineers or your local Eagan representative or the factory engineers offer their services for any pump requirement."

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Pipe joints sealed with Key-Tite cannot leak. Key-Tite is a perfect seal on all lines carrying water, gas, low-pressure steam, compressed air, etc. It contains no lead or substitutes and does not affect the taste or odor of potable liquids. Joints are easily opened, too, for it will not freeze in the joint. Stop losing money through leaky pipe joints...seal with Key-Tite.

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Try Key-Tite in Your Own Plant at Our Expense

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form to be filled out by designers and engineers who wish advice on the selection of the proper size, type and grade of ring for particular applications. Space is allotted for information on the specific operating conditions, mechanical design and dimensions involved. The completed form is sent to the company's technical service staff.

Operator for Throttling Control Service

HPAC 121—Conoflow Corp., 2100 Arch St., Philadelphia 3—Bulletin C-1 describes the special features, dimensions, methods of operation and various applications of the "Cono Rotomotor," a completely pneumatic, gear driven operator for throttling control service in catalyst slide valves, large gate valves, heavy dampers, and similar applications.

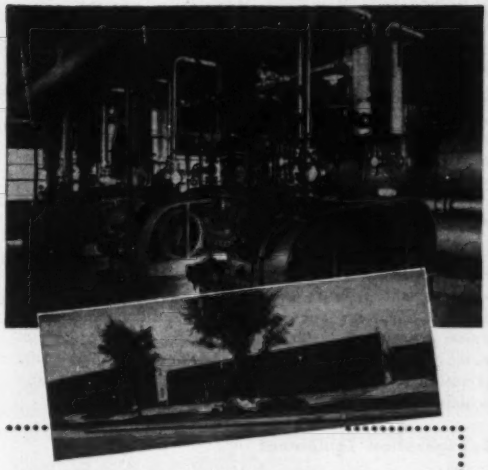
Packaged Electric Heaters

HPAC 122—Edwin L. Wiegand Co., 7500 Thomas Blvd., Pittsburgh 8—Folder covers packaged heaters — immersion, circulation, and others which also have built in controls. Various installations are illustrated.

Packaged Steam Generators

HPAC 123—Orr & Sembower, Inc., Morgentown Rd., Reading, Pa.—Bulletin 1218 gives information on the "Powermaster" packaged steam generators (ranging from 15 to 500 hp), for steam or hot water use.

SERVICE Instruments for Measuring
AIR TEMPERATURE and AIR VELOCITY
TEMPSCRIBE
Recording Thermometer
Available in 10 different ranges to cover −30°F to +110°F temperatures, and with spring-operated chart drives for any of the following chart rotations: 8 hours, 24 hours or 7 days.
This entirely self-contained, compact and reliable temperature recorder automatically writes a continuous record of temperature changes on a replaceable chart. Record shows at a glance maximum and minimum temperatures and the duration of temperatures above or below any given point; also shows the exact time of every temperature change and how rapidly it takes place. Recording pen and bi-metallic element are built in hinged, removable door which is also front of instrument. Thus, by merely changing doors it is easy to interchange temperature ranges or to convert to the Operation-Time Recorder described below. Instrument is 8" tall, 5½" wide and 4½" deep. Charts are 4½ inches in diameter.
• OPERATION-TIME RECORDER
This instrument has a door unit which is identical to the door of the Recording Thermometer shown above. It makes record of number, frequency and duration of electrical operations such as starting and stopping of motors, heaters, etc. Pen is moved by the energizing of an electro-magnet when contact is closed. Available for either parallel or series connection.
Ask your Jobber or Write for Bulletin 720
FLORITE
Air Velocity Meter
Available in two styles:
One with a scale of 0-1000 ft./min., and the other with a double scale of 0-3000 ft./min. and 0-35 miles per hour.
In principle, this unique instrument operates as an anemometer but provides instantaneous, direct readings of air velocity without timing, calculations or reference to charts. Readings are obtained by holding the instrument in the air stream so that air blows against its circular face, causing rotation of a multi-blade rotor mounted in instrument housing. The circular scale surrounding the rotor instantly turns to correct air velocity reading under an index pointer on scale window. This direct-reading anemometer is particularly useful for measuring air current velocities of air conditioning systems, grille velocities and air deliveries from registers and grilles; for balancing forced air heating systems, and for checking air distribution of all kinds of ventilating systems. Furnished with detachable handle (as illustrated), and leather case.
Ask your Jobber or Write for Leaflet 760
BACHARACH Industrial Instrument Co. 7000 BENNETT STREET • PITTSBURGH 6, PA.



It's VILTER Again—

Sealtest ICE CREAM IN NATIONAL DAIRIES' NEW MILWAUKEE PLANT

● When National Dairies engineers were considering refrigeration for the contemplated new Luick Ice Cream Company plant, they naturally gave thought to the equipment which had faithfully served through the years. They discovered that Luick had bought their first Vilter compressor in 1911 and has been buying Vilter ever since.

Refrigeration had advanced over the years, along with the process of ice cream manufacture, so no thought was given to moving the old equipment, but rather toward buying an entirely new system. Promised efficiency improvements were realized through the installation of the four Vilter multi-cylinder compressors shown, three twin cylinder boosters, shell and tube condensers, and other equipment.

Dairies, ice cream plants, and food processors have known for years that they can depend upon Vilter. You'll find them re-ordering Vilter, as Luick has done, time after time, because they've found that Vilter saves them money in upkeep, in operating costs, and in lack of costly "down time."

Let your nearest Vilter Representative or distributor show you how you can save with Vilter.

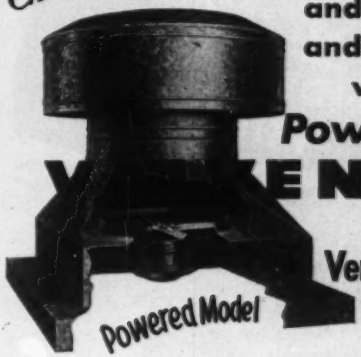
Vilter

REFRIGERATION and AIR CONDITIONING

THE VILTER MANUFACTURING COMPANY
MILWAUKEE 7, WISCONSIN
Ammonia and Freon Compressors • Pakicers • Evaporative and Shell & Tube Condensers • Pipe Coils • Valves and Fittings • Can Ice Plants

Chase out bad air!

and fumes and smoke with Powerful VALVENT Roof Ventilator



Use or recommend VALVENT for economical ventilation of small buildings or relief over "hot spots" in *any* structure. In hundreds of places—industrial, commercial, public buildings—VALVENT fills a need for well-made moderate priced roof ventilation equipment.

Sturdily built of galvanized steel in an effective air-flow design, VALVENT also has a pleasing appearance. Powered model is equipped with guaranteed motor driving square tipped blade propeller fan. Capacities available range from 980 to 66,200 cfm. Unique inverted cone damper serves as air stream guide when open. Simple damper-chain lock permits any opening from full open to competely closed. The ventilator is fully weatherproof, either open or closed.

Also for Gravity Ventilation

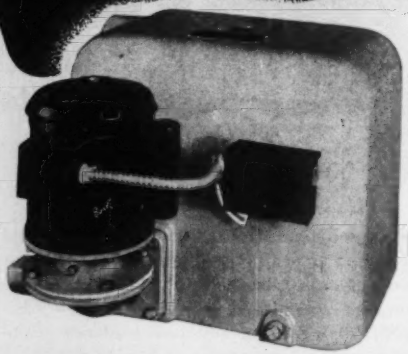
VALVENT is also supplied without power unit —otherwise same design. Gravity flow of heat, smoke and fumes passes smoothly upward with least possible friction. Both powered and gravity models are made in 12 throat diameters—12, 15, 18, 24, 30, 36, 42, 48, 54, 60, 66 and 72 inches. Base designs are available to fit any type of roof. Write for full details on the VALVENT.

Gravity and powered roof ventilators for every roof ventilating need.

The Swartwout Co.

18511 Euclid Avenue • Cleveland 12, Ohio
Industrial Ventilation Specialists Since 1904

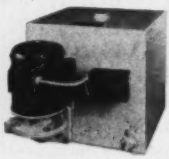
Sterlco
CONDENSATION PUMPS



Proving THEMSELVES *in*
INSTALLATION *after* INSTALLATION

Time after time, Sterlco Condensation Pumps have proven they can do a better job — and there are many reasons why. Take, for instance, the Sterlco 4200 Series Condensation Pump. It is designed to do one job, and do it outstandingly well. Rated conservatively, the 4200 can actually safely deliver its full rated output continuously for long periods — and its many exclusive features cannot be found in much higher priced pumps. Yes, it's no wonder Sterlco *always* does a better job.

- LONG WEARING Carbon-Type ROTARY SEAL
- LARGE CAPACITY TANK
- COMPACT, NEAT APPEARANCE
- EASY ACCESSIBILITY OF PARTS



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Pipe Insulation

HPAC 124—Ehret Magnesia Mfg. Co., Valley Forge, Pa.—Bulletin 4h presents the characteristics of "Thermalite" 85 percent magnesia insulation for covering pipe, fittings and equipment. Tables give recommended insulation thicknesses for various temperature ranges. Other insulations, such as "Heat-Seal" blankets and insulating cements, also are covered.

Pressure and Temperature Relief Valves

HPAC 125—Watts Regulator Co., Lawrence, Mass.—Folder discusses the applicability of the combination temperature and pressure relief valve in the protection of domestic hot water tanks and heaters, and the combination water pressure and steam pressure relief valve for hot water space heating boilers. The need for preventing excessive temperature in domestic hot water tanks and heaters is emphasized.

Refrigeration Equipment

HPAC 126—The Whitlock Mfg. Co., 44 South St., Hartford 10—Bulletin 140 gives dimensions, specifications, etc., for standard ammonia condensers and brine coolers, dry expansion type water chillers for air conditioning service, "Freon" condensers, receivers, and refrigerant coils.

Rehabilitation After Flood

HPAC 127—The Marley Co., Inc., 3001 Fairfax Rd., Kansas City 15, Kan.—Booklet, *In Spite of High Water,*

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COILS
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A full line of sizes now available to meet all industrial requirements. Send for catalog.

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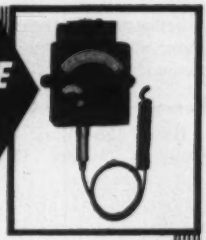
NEW TYPE CI

ADJUSTABLE THERMOSTAT



The new Type CI Adjustable Indicating Thermostat is a precise temperature control for gas, liquid, and metal-to-metal applications, such as ovens, hot plate presses, water baths, incubators, proofing cabinets and cold cabinets. It is most useful on units where periodic checks of temperature are required, advisable, or will prove time-saving. The new Type CI is simply and ruggedly built, employing the highly sensitive response action of a solidly liquid-filled bulb and bellows assembly to a snap-acting switch and indicating pointer. The thermostat is adjustable over its entire range by a knurled thumbscrew on the front of the case.

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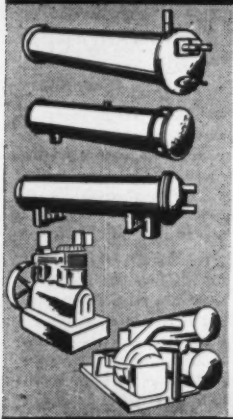

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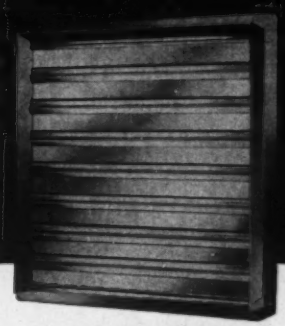

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describes the effects of the recent flood on the Kansas City plant, and the rehabilitation process which led to the resumption of full production.

Remote Room Air Conditioners

HPAC 128—Marlo Coil Co., 6135 Manchester Rd., St. Louis 10—Bulletin 1149 lists complete performance data and specifications of remote room air conditioners used for cooling, heating, ventilating and filtering in multi-room installations. Units are individually controlled and no ductwork is needed.

Roof Ventilator

HPAC 129—Penn Ventilator Co., Goodman above Allegheny Ave., Philadelphia 40—Report describes recent tests, conducted by United States Testing Co., Inc., in which the "Liberty Syphonage" roof ventilator was installed at various angles in a horizontal wind tunnel and subjected to a number of different wind velocities, with no resulting backdrafts.

Roof Ventilators

HPAC 130—Iron Lung Ventilator Co., 4019 Prospect Ave., Cleveland 3—Folder gives ratings and dimensions, and describes the special features of industrial roof ventilators. Typical applications are shown.

Silent Check Valves

HPAC 131—The Williams Gauge Co., 1620 Pennsylvania Ave., Pittsburgh 33—Bulletin WH-100 covers silent

Yes, we could write a book— on this subject because we've been supplying heat transfer equipment to industry for a good many years. Take this C-E Re-circulation Steam Generator, for example. It's engineered to respond quickly and automatically to wide load variations in steam demand. It employs a high capacity Whitlock Type V multi-pass fuel oil heater to maintain correct oil viscosity, permitting this steam generator to be brought from a cold start to full output in a few minutes.

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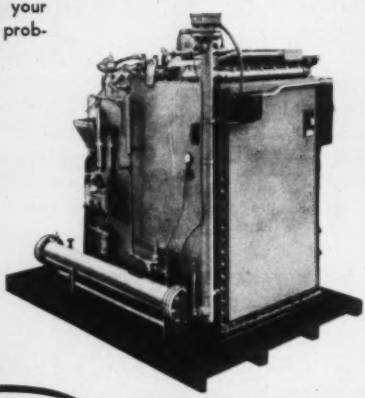

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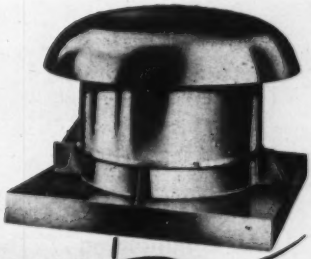

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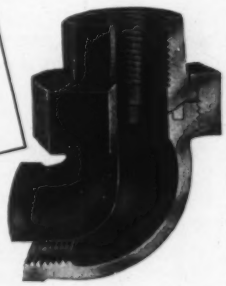

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SAVED 10% IN STEAM COSTS

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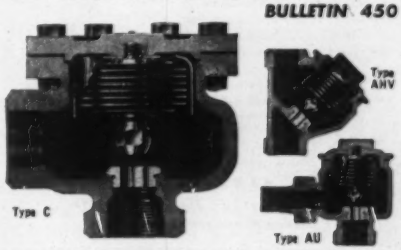

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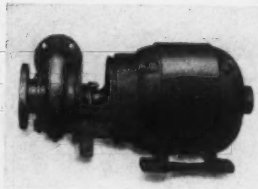

Fig. 3650 Close-Cupld Centrifugal

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Satisfied customers are your best salesmen for air conditioning. When an installation operates smoothly—without breakdown or repair—you have fewer headaches and your customer's satisfaction builds new sales for you.

Using exactly the right pump for the job eliminates one source of trouble. Goulds has a wide selection of Close-Cupld pumps for air conditioning. These Goulds pumps are famous for long, carefree service—which is the kind of service that means satisfied customers—and new business! For larger jobs Goulds Double-Suction Centrifugals are equally dependable.

Call or write Pump Headquarters for complete information.

Goulds PUMPS INC. Seneca Falls New York

check valves designed to prevent water hammer and pressure surges. Included are technical data and a series of installation photographs.

Steam Cost Calculator

HPAC 132—Cleaver-Brooks Co., 326 E. Keefe Ave., Milwaukee—Pocketsized calculator designed for computing comparative steam costs per 1000 lb, using coal, oil or gas, contains on the reverse side technical data on the company's equipment (boiler hp, lb of steam per hr, output in Btu, oil consumption per hr, etc.).

Storage Water Heaters

HPAC 133—The Whitlock Mfg. Co., 44 South St., Hartford—Bulletin 40A describes the type K storage heater, for use in hospitals, plants, schools, and similar installations, where the demand for hot water and the steam or the heating medium supply may be intermittent. Various types of construction are covered, installations are illustrated, tables are given for dimensions, pressure, thickness, conversion factors, etc., and typical layouts are diagrammed. Bulletin 46 is a data sheet giving condensed information on the heaters.

Titanium

HPAC 134—Allegheny Ludlum Steel Corp., 2020 Oliver Bldg., Pittsburgh—The *Al Quarterly* (company house organ) for the third quarter, 1951, covers the uses, sources, processing and general characteristics of titanium metal.

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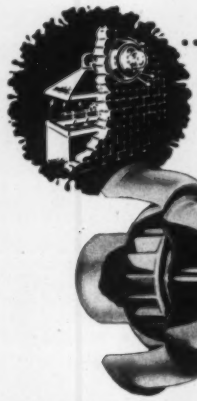

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- ★ REDUCED PRESSURE RANGE 5-75 psi

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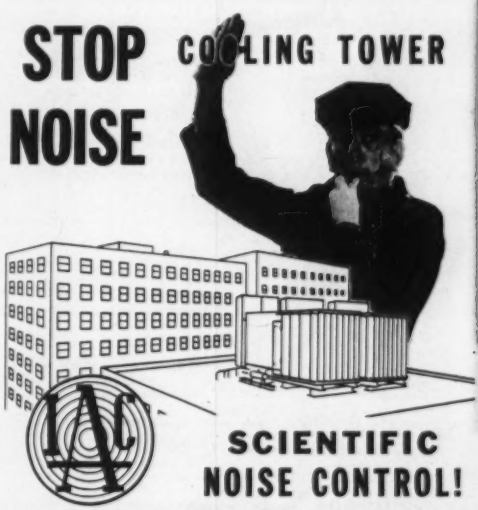

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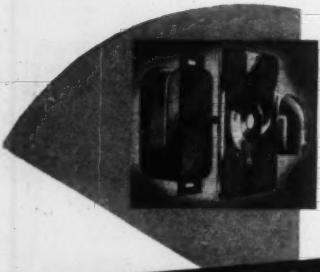

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Time ranges from 3 minutes to 12 hours.
Rated at 20 ampere, 125 volt or 10 ampere, 250 volt, 1 HP operation. AC only.
Available for either ON type or OFF type operation.

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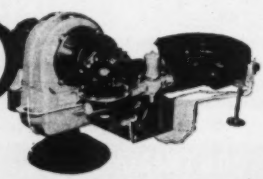

SIEMON & CO. 1819 HOLMES KANSAS CITY, MO.

Totally Enclosed Motors

HPAC 135—Allis-Chalmers Mfg. Co., 1171 S. 70th St., Milwaukee—Bulletin 05B7682 covers totally enclosed motors with air to water heat exchangers, describing the three types of cooler arrangement (foundation, side or top mounting) built into the motors, and explaining methods for estimating water requirements.

Ultrasonic Testing

HPAC 136—Sperry Products, Inc., Danbury, Conn.—Bulletin 50-115 describes commercial ultrasonic testing services, for metals and other materials, in the field and at the company's testing laboratory.

Valve Design

HPAC 137—Edward Valves, Inc., 1200 W. 145th St., East Chicago, Ind.—The relation of experimental stress analysis to valve engineeering and designing is discussed in the article, *Experimental Stress Analyses Help Shape Up Better Valve Designs*, by W. L. Hemingway, company research metallurgist. The article appears in the current issue of the house organ, *Valve Values*.

Valves, Controls, etc., for Power Plants

HPAC 138—The Swartwout Co., 18511 Euclid Ave., Cleveland 12—Bulletin S-196-C, a condensed catalog of power plant equipment, covers control valves, pressure master controls, desuperheaters, temperature master controls, water regulating valves, liquid level and drainage

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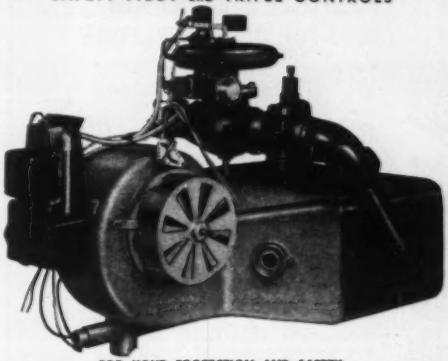

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4366 Worth Street, Zone 63, Los Angeles, Calif.

Statement of Ownership and Management of

HEATING, PIPING & AIR CONDITIONING

for October 1, 1951

The following is a statement of ownership, management, etc., as required by the act of Congress of August 24, 1912, as amended by the acts of March 3, 1933 and July 2, 1946 (Title 39, United States Code, Section 233) of Heating, Piping & Air Conditioning, published monthly at Chicago, Ill., for October 1, 1951:

1. The names and addresses of the publisher, editor, managing editor, and business manager are:

Publisher, F. P. Keeney, Chicago, Illinois.

Editor, C. M. Burnam, Jr., Chicago, Illinois.

Managing Editor, C. M. Burnam, Jr., Chicago, Illinois.

Business Manager, Chas. E. Price, Chicago, Illinois.

2. The owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 percent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual member, must be given.)

Keeney Publishing Company, 6 North Michigan Avenue, Chicago 2, Illinois. Stockholders: F. P. Keeney, Chicago, Illinois; W. J. Osborn, Fairfield, Conn.; Chas. E. Price, Chicago, Illinois; Robert A. Jack, Cleveland Heights, Ohio.

3. The known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are: None.

4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

F. P. Keeney, Publisher.

Sworn to and subscribed before me this 24th day of September, 1951.

Grace E. Waymire.

[My commission expires February 10, 1954]

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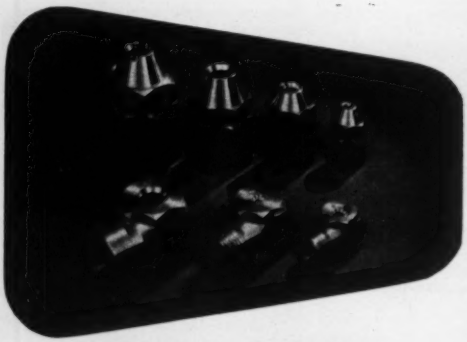

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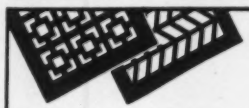

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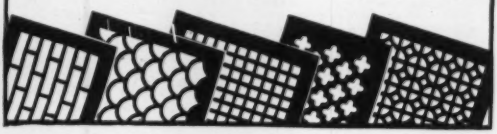

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